Vol. 19 October, 1925 No. 2

QUARTERLY

OF THE

National Fire Protection Association

Entered as second-class matter May 1, 1911, at the Post Office at Boston, Mass., under act of July 16th, 1894.

40 CENTRAL STREET, BOSTON, MASS.

National Fire Protection Association

INTERNATIONAL.

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Underwriters' Bureau of Middle and Southern States.
Underwriters' Bureau of New England.
Underwriters' Laboratories.
Underwriters' Service Association.
Union, The.
United States Fireworks Manufacturers' Association.
Washington Surveying and Rating Bureau.
Western Actuarial Bureau (Fire).
Western Canada Fire Underwriters' Association.
Western Factory Insurance Association.
Western Insurance Bureau.
Western Sprinklered Risk Association.
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Reports of fires appearing in the Quarterly are copies of or extracts from written reports forwarded to the Association. This Association, as a body, is not responsible for the statements or opinions of any of its members.

Wide World Photo.

A view of Manizales, capital of the State of Caldas, Columbia, situated 110 miles northwest of Bogata, after the conflagration which destroyed some thirty-two blocks in its principal business section and made 40,000 people homeless on July 4, 1925. An explosion in a drug store which ignited gasoline and other flammables stored there is the reported cause of the fire. Reports state the loss at $20,000,000 but do not say whether it is expressed in dollars Mexican or American. The loss is large in either case.

We read that the total amount of property destroyed by fire in the United States last year was equivalent to more than half the annual interest on the national debt. Thus the prize for the world's most useless statistic remains in America for another year. —*Life.*

The Quarterly

Vol. 19 October, 1925 No. 2

Fire Prevention Week, 1925. Fire Prevention Week, 1925, eclipses all previous observances of the Week, according to the reports from Mr. T. Alfred Fleming, Chairman of the N. F. P. A. Committee on Fire Prevention Week, which are confirmed by the volume of preliminary correspondence and the extent of requests for posters and other material received by the N. F. P. A. Executive Office. The widespread co-operation received is gratifying evidence of the increasing popular interest in fire prevention. Space does not permit mention of the many outstanding features of the Week.

The indications of increased popular interest brought out by the observance of Fire Prevention Week do not show any lessened need for continued fire prevention effort. As the *New York Herald* observes: "Fire Prevention is evidently one of the hardest things the people of this country have to learn. It needs incessant attack to make any impression on the burning habit."

* * * * *

"Fire Destruction Helps Business." The *Boston Herald* of October 4th uses this heading in a local report with the sub-head, "Loss of Nation results in $550,000,000 worthy work." Following is the text which suggested these headlines to the editor:

The truth of the ancient and honorable adage concerning the ill-wind is well exemplified by the fire destruction of the country, according to Robert Beck, president of the Longacre Engineering and Construction Company, who yesterday pointed out that the current fire losses of the nation result in work for builders, contractors and others, involving about $550,000,000 a year.

"This is a tidy sum even in these days of heavy expenditures," says Mr. Beck, "and represents considerably more than a drop in the building bucket. While this destruction by burning is really an economic waste borne by all of us, its effects upon the activities of the structural trade cannot be ignored, although this factor is usually overlooked. Besides builders, others who profit by the effects of the element are architects, decorators, plumbers, merchants dealing in various commodities, including house furnishings."

It would be interesting to know just how far this idea possesses the minds of architects, builders and tradesmen and to what extent it governs their attitude toward the fire prevention movement. We know men in these occupations who would not willingly profit personally through the misfortunes of individuals or of their country; but as there are merchants who deliberately burn their goods for money collected from the public, so it is reasonable to suppose that those who have seen their sales of certain commodities quickened by fires in their cities are not averse to what they may consider a reasonable amount of destruction of the property of others. Profits of this sort, however, are more apparent than real as any impoverishment of the nation reacts through many unrealized channels upon all the people in it. An architect may get an extra job or two through the burning of his city, but the rise in rents due to building shortage, the migration of citizens to other places, and the eventual spreading of the losses over the commodities he needs for his daily life make an endless chain which pulls him back as fast as he moves forward. He works without progress; the gains going into one pocket are extracted from the other. Any effort that is demanded merely for the replacement of waste must be just so much withdrawn from the enrichment of life: it is doing things over again that should be well done and stay done so long as they will adequately serve human need.

* * * * *

The Manufacturer's Viewpoint.

Mr. H. L. Miner's message to the fire marshals which we print in this issue is obviously not to be interpreted as a note of objection to proper public regulation of special hazards. Mr. Miner has been a consistent fire preventionist in both thought and action for many years, and knows as well as anybody that with conspicuous exceptions special hazards have been ignored and neglected by industry until public opinion has compelled attention to them; also that the hazards he points out as the principal fire causes are as commonly present in American factories as in homes. The Committee on Trade Associations of the Fire Waste Council of the Chamber of Commerce U. S. A., has been created to attempt to influence the various industries to make a study of their process or special hazards with a view to safeguarding them and reducing fires from these and the common hazard causes usually present. The National Wholesale Druggists' Association long ago successfully did this and the National Retail Dry Goods Association is now undertaking it. (See *News Letter,* August, 1925.)

The point made by Mr. Miner is that we should keep a proper perspective and not overlook in our desire to control the big target hazards of industry, the common hazards that make up the main bulk of our great

losses in homes and factories and which most of us individually may directly help to correct. It is upon this thought that the field service of the N. F. P. A. is based. Its object is to create, encourage and perpetuate conditions of municipal housekeeping that will largely eliminate the causes emphasized by Mr. Miner as the principal agencies of the destruction which he so forcibly points out is menacing our continued progress and well being. Evidences are multiplying that the manufacturers of America are desirous of co-operating in this effort.

* * * * *

Half Loaves. Half a loaf is better than no bread, but why be satisfied with one slice when the whole is within easy reach? In the multitudinous details of fire protection there are many gradations between the full loaf and nothing. Compromise is frequently necessary if any sort of protection at all is to be obtained. The dictates of expediency often lead to the acceptance of semi-fire-resistive construction and partial protection. To a considerable extent such compromise is legitimate, and may be justified by the practical facts of the case. The habit of compromise, however, is a dangerous one. It results in the toleration of sub-standard conditions in situations where 100% fire safety is practicable and should be insisted upon.

A serious phase of this habit of compromise is the tendency it has to dilute the results of public education in fire prevention. The continued educational campaign of the N. F. P. A. and its members, the general advertising of fire protection devices and various other influences have created a definite public demand for fire safety. This demand ought to be satisfied, wherever it manifests itself, by providing the best of methods, materials and devices that are obtainable under the circumstances.

The fact that this is not always accomplished seems chargeable in some part at least to a failure on the part of some purveyors of fire protection materials and equipment to realize their responsibilities and opportunities. Aroused by the exercises of Fire Prevention Week, and influenced by the advertising of fire equipment manufacturers, Mr. Common Citizen visits a store, bent on purchasing a fire extinguisher for his home. In the display window he sees approved extinguishers bearing the label of Underwriters' Laboratories, and beside them dry powder tubes and colored bottles of liquid. All are called fire extinguishers. He does not discriminate between the several devices sold by the reputable dealer. Is the purchaser to be blamed for selecting the least expensive one?

A parallel case is that of the man whose newly acquired interest in fire protection leads him to the decision that his new building shall be "fireproof." He soon encounters men anxious to sell him various "semi-fireproof" materials, or even paints supposed to make wooden buildings "fireproof." The easiest way is to compromise.

Those who have had experience in the business of fire protection can discriminate intelligently between the various devices and materials, they know the limitations of partial protection. But the newcomers to the fringe of our widening circle do not appreciate the quality distinctions in fire protection. It is our duty to help educate the initiates and it is particularly important that those commercially interested in fire protection do their part by declining to deal in or sell anything that will not afford real fire safety.

* * * * *

Bankers Who Look to the Future. A new form of intolerable paternalism, some would call it, and of great wisdom, others would say, is reported from Louisiana. The bankers of that State, when they lend money on timber lands, now are putting in the mortgage given by the borrower a provision that will prevent him from letting the land become and remain nearly worthless after he has removed the trees. The clause reads:

> The mortgagor does hereby further bind himself to put his waste or idle lands not suitable to agriculture to trees and to protect all forest trees and tree seedlings growing on any of the above-described lands, and he further pledges that fires or other destructive agencies will be prevented wherever possible.

Here is reforestation and fire prevention made obligatory over large tracts of land in a State where the lumbermen, if left to their own devices, might act as ruthlessly as most of them have in all the other States.

Trees are such a slow-growing crop and returns from them are so long deferred, that forestry, as a rule, is not considered "good business" for private individuals or private corporations, and is left to the State and Federal Governments—when it receives any attention at all. Yet, as everybody admits who has studied the subject, there are large ultimate profits in forests, and, once in order, there is no difficulty in making them bring in an annual income proportioned to investment.

* * * * *

The Santa Barbara Earthquake. The San Francisco fire of 1906, the more recent disaster in Japan, and the history of major earthquakes throughout the world lead to the commonly accepted notion that a conflagration is the almost inevitable aftermath of any serious earthquake. Authorities on fire prevention have often qualified their statements that almost all fires were preventable, by citing the earthquake as a fire cause beyond human control. The Santa Barbara earthquake of June 29, 1925, is a notable exception.

The severity of the shock seems to have been comparable with previous serious earthquakes. According to the report of the Board of Fire Underwriters of the Pacific (Member N. F. P. A.), few buildings in the

business section escaped more or less serious damage. A conflagration was avoided by the prompt cutting off of electric current and gas supply. Great credit is due to the electric substation operator who risked his life during the collapse of the building to break the necessary connections. One small fire, starting in the residential district, was promptly extinguished.

The water supply system was damaged, as in the case of other earthquakes. Several breaks occurred in important lines. Interconnections, however, were available to supply all deficiencies and repairs were made immediately, there being no interruption to the water supply for more than a few minutes.

Due principally to good organization prior to the disaster, no time was lost in instituting emergency relief, and the value of placing all city authority under a single head was amply demonstrated. Extra fire equipment, engines and fire boats, arrived from Los Angeles in record time and strict regulations were enforced as to the use of stoves and chimneys.

Great credit is due to the authorities for the prompt measures that proved effective in preventing a conflagration.

* * * * *

Drugs and Fire Escapes.

The duly elected representatives of the people in legislature assembled enact some strange and wonderful statutes in the course of codifying their composite wisdom for the benefit of their constituents.

The sovereign state of South Dakota has made provision, as all state governments should, for the appointment of a state fire marshal. A pamphlet, entitled "State of South Dakota, Fire Marshal Department, Laws 1925," defines his powers and duties in connection with the prosecution of arson, supervision of motion picture projecting equipment and the like. The same pamphlet, however, contains other provisions of the law, such as the specific permission to set fires for the purpose of destroying grasshoppers. Section 7833 specifies that certain hotels and other buildings "shall be provided with an iron fire escape to be approved by the *State Food and Drug Commissioner.*"

"Watch Our Smoke"

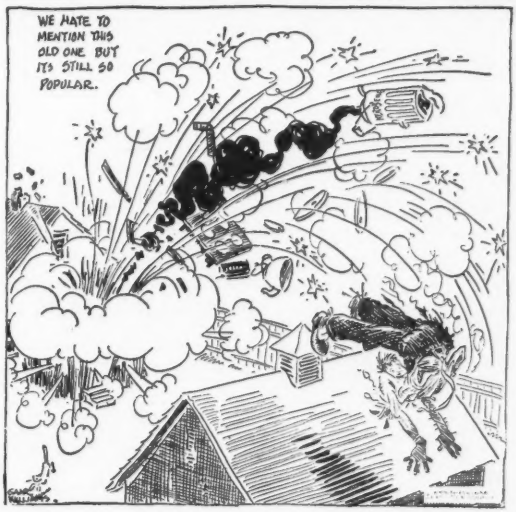
FIRE PREVENTION WEEK
ARE WE PROUD OF THIS ONE
HOLDER OF THE WORLD'S RECORDS IN ALL LINES
15000 DEATHS AND $548,000,000 PROPERTY LOSS DUE TO FIRE DURING 1924 - MOST OF WHICH WAS PREVENTABLE

Burtt
in the
Knoxville
Journal

At the Rate of One Every Three Minutes

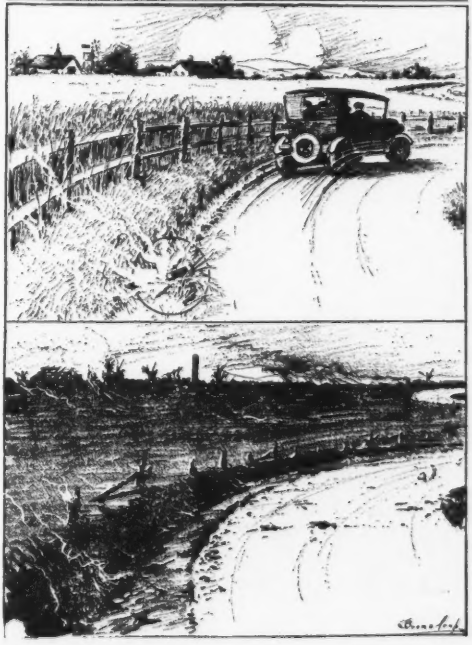
Pease
in the
Newark
Evening News

HOW TO KEEP FROM GROWING OLD



Williams in the Chicago *Tribune*

CAUSE AND EFFECT



Bronstrup in the San Francisco *Chronicle*

Executive Committee Action.

After consideration of the items referred back to it with power by the 29th annual meeting, the Committee on Building Construction recommended for adoption by the Executive Committee the following amendments to the Specifications for Private Residences, which have been acted on favorably by letter ballot sent out under date of August 5. Refer to 1925 Proceedings, page 411.

Specifications for Private Residences.

General Requirements.

Article 28. Plastering.

(b) Change period to comma and add: "provided, however, that where incombustible lath or wood lath is permitted, plaster on metal lath may be one-half inch thick."

(c) Reletter this paragraph (d) and insert the following new paragraph (c): "Plaster bases where required shall not be less than the following. Metal lath shall be expanded, woven wire or sheet metal lath. Expanded metal lath for walls and partitions shall be not less than No. 26 U.S. gauge, weighing not less than 2.5 lbs. per sq. yd.; for ceilings not less than No. 25 gauge, nor less than 3.0 lbs. per sq. yd. Wire lath for walls and partitions shall be not less than No. 19 gauge; for ceilings not less than No. 18 gauge, and when used on 16 inch centers shall be not less than 2½ meshes per lineal inch. Sheet metal lath shall be not less than No. 30 gauge. Plaster board and wall board shall be not less than ⅜ inch thick of quality specified in Article 27 (b)."

Private Residences—Grade C.

Floor and Roof Construction.

Roofs. Change third paragraph to read as follows: "Roof coverings shall be not less than equal to Class C for flat roofs or Class B for peaked or hipped roofs, as classified by the Underwriters' Laboratories."

Private Residences—Grade D.

Buildings Not Exceeding 2 Stories in Height.

Interior Finishing. Change second paragraph to read: "Duplex buildings shall have incombustible lath and plaster for the finishing of all construction separating families, and on basement ceilings."

Buildings Not Exceeding 3 Stories in Height.

Interior Finishing. Change second paragraph to read: "Duplex buildings more than 2 stories in height shall have expanded metal lath or wire cloth and gypsum or cement plaster for the finishing of all construction separating families and on basement ceilings."

PRIVATE RESIDENCES—GRADE E.

Buildings Not Exceeding 2 Stories in Height.

INTERIOR FINISHING. Change second paragraph to read: "Duplex buildings shall have incombustible lath and plaster for the finishing of all construction separating families and on basement ceilings."

Buildings Not Exceeding 2½ Stories in Height.

INTERIOR FINISHING. In second paragraph replace the words, "walls, partitions and ceilings" with "construction."

Buildings Not Exceeding 3 Stories in Height.

INTERIOR FINISHING. In first paragraph omit words, "Duplex, Double Duplex or." In second paragraph replace the words, "walls, partitions and ceilings" with "construction," change period to comma and add, "and on basement ceilings."

PRIVATE RESIDENCES—GRADE F.

Buildings Not Exceeding 2 Stories in Height.

INTERIOR FINISHING. Change second paragraph to read: "Duplex buildings shall have incombustible lath and plaster for the finishing of all construction separating families."

Buildings Not Exceeding 2½ Stories in Height.

INTERIOR FINISHING. In first paragraph omit words "Duplex or." Change second paragraph to read: "Duplex buildings more than 2 stories in height shall have expanded metal lath or wire cloth and gypsum or cement plaster for the finishing of all construction separating families, and on basement ceilings."

Calamity.

By Ruth Dinwiddie, Indiana University.

Awarded First Prize in 1924-1925 Atlantic Monthly Essay Contest for College Students.

One late fall day, when there had been no rain for weeks, a tenderfoot party smoked cigarettes, against the express orders of the ranger, whose word is law in that country whence I came. Cigarettes, as all men know, have stubs and stubs are dangerous, for in them lie tiny live sparks. That night a brisk breeze which came up fanned one of those tiny sparks into a little blaze. That little blaze grew into a big blaze, and the mountain five miles from us, across the lake, became a mass of flames. The ranger soundly cursed those tenderfeet and sent for fire-fighters.

By morning the tenderfeet had paid their penalty—where or when nobody knew or cared; for in that land one always pays for carelessness.

But we paid, too. Our sky was a lurid gray by day, with the sun a queer orange ball; by night it was a vivid red with neither moon nor stars, yet all night long one could see as clearly as in the day. The ground was dead-gray with ashes—they banked knee-deep. The lake, the largest body of fresh water west of the Great Lakes, went down and down and kept going down until our water-pipe, which in normal dry weather was covered by several feet of water, lay on the surface, and we must needs run out an emergency line. The pump went all day long to keep our roof whole and to protect less fortunate neighbors. And always that horrible gray of the day and terrible red of the night. The state militia came to fight the dragon. The wind shifted and wiped out half of them. My cousin was in the half saved—so we learned after several days; but oh, those days of waiting! The mill was closed for the first time and the mill hands turned into fire-fighters, not at the scene of the fire but in the little town, to save their homes and jobs. For several weeks it was the same—gray days, red nights, ashes, smoke, an occasional local fire, people red-eyed from loss of sleep, yet not daring to sleep except in short relays.

At last, one day when people were beginning to give up hope of ever stopping that fire; when they had decided that the valley was doomed too; when it had become such a furnace that slickers were no longer sufficient protection from the burning ashes; when people were beginning to collapse physically and a terrible fever had broken out; when the apple-growers had given up all hope of saving their orchards—then came the

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rain. A perfectly clear sky, and in fifteen minutes the rain was coming down in torrents, bucketfuls, a solid sheet. We watched it, praying for more. And more came, and yet more, until the hills were flooded and every creek was far out of its banks. Then, as suddenly as it had started, the deluge stopped. The sun came out again to dry things up and show us our ruined country.

What a difference those weeks had brought! Our snow-topped mountains were no longer snow-topped. We could not understand why that melting ice had not vanquished the fire, but it hadn't. Those mountains were an ugly mass of blackened rock and dirt, with a few half-burned stumps and trees sticking into the sky. There was no green thing on our side of the valley. Even the pines and firs had lost all their needles. This year's crops were hopelessly ruined. Many of the orchard trees were dead.

The lake came up and up and up again, for the snow had all melted. It came by leaps and bounds. It flooded the mill grounds; it flooded the lowland orchards; it flooded the roads; it swept away telegraph and telephone poles; it covered our pumping station, which was well above the highest of the previous flood-lines. The fire had started the glacier melting, and the hot sun had kept on. Those three immense snow-patches, which had withstood all onslaughts for ages, had at last succumbed.

We said, "Is there *no* end?" And we prayed; not on our knees, for there was no time for that, but as we worked. And how we worked! There was so much to be done. For the rising water said, "It is my turn now. Leave your dead and attend to me, else I will take all you have left." And we helplessly obeyed.

Finally even that ended. The water slowly went down again. We thanked God for what little was left us, and turned our attention to repairing the damage as best we could; turned our attention to the remnants of years of hard work; turned our attention to our dead, our hurt, our missing, our wrecked homes, our ruined roads, our orchards piled high with débris. We had plenty to turn our attention to, with winter not far away; so we did not let up until the snow came and covered all the ugliness, all the burned things and the new graves. Then we too rested, and thought of our dead, for one cannot work in that country after the snow comes.

But one party of tenderfeet never came home. They had thought they knew more than the ranger.

Fire Prevention from a Manufacturer's Viewpoint.

By H. L. Miner, (Member N. F. P. A.)

Manager, Fire Protection and Insurance Division, E. I. duPont de Nemours & Company.

For some time I have had a number of very definite thoughts on this subject. These ideas or thoughts are largely personal. I feel, however, that they would express to a great degree any manufacturer's viewpoint if he were to carefully analyze the fire waste problem, for the manufacturer wants results—whether the problem is one of lowering manufacturing costs, increasing efficiency, increasing production or any other question which has a definite bearing on the success of his business.

Those of us who have been actively working for the furtherance of fire prevention activities in America fully realize that drastic action must be taken to check the increasing and needless destruction by fire of our country's resources if we are to continue a prosperous country and progress as we have in the past.

Based upon current statistics, we are losing ground in our fight to reduce the yearly fire waste. Each year's losses exceed those of previous years. The fire loss for the first eight months of this year is reported to exceed that of the same period last year by $22,000,000. The life loss is not decreasing. The number of people crippled and maimed as a result of fire remains practically the same.

No one knows better than I the tremendous amount of thought, time and effort that has been put on this problem and I can hardly believe, even in the face of such adverse reports, that it has been wasted. It may be that we must expect larger property and life losses, whether from fire, earthquake, tornado or other disaster, because of the ever increasing aggregations of value and people. If this is true it is equally true that we will have to materially increase our efforts to show any reduction in losses, to say nothing about preventing a substantial increase in years to come.

For many years there has been carried on a most intensive fire prevention campaign by organizations individually and collectively, for example, the National Fire Protection Association, National Board of Fire Underwriters, Underwriters' Laboratories, the National Fire Waste Council (which is composed of some twenty-one national and interna-

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From an address at Fire Marshals' Convention, San Antonio, Texas, September, 1925.

tional organizations interested in conservation work and exists for the purpose of assisting the organization members of the United States Chamber of Commerce), the Fire Marshals' Association of North America, National Association of Insurance Commissioners, International Association Fire Engineers, National Association of Credit Men, National Association of Insurance Agents and many others. Very satisfactory results have been obtained wherever public interest has been aroused to a concentrated effort, showing that it is entirely within the scope of human reason to expect a vast reduction in this yearly waste. However, in the aggregate, losses are increasing and our problem today is to determine how we can best capitalize, in the immediate future, on the foundation which has already been laid.

At this point I wish to present the salient fire loss facts which should be kept in mind, namely:

First, the annual fire loss is increasing, last year approximating nearly $600,000,000, an absolutely irreplaceable loss.

Second, that the destruction of our forests, grain fields, etc., which is no small part of the total loss, is bringing about other consequential losses, particularly as regards the forests and our water sheds.

Third, that 15,000 men, women and children were killed last year by fire and twice as many crippled and maimed, many more being injured; an economic loss amounting to hundreds of thousands of dollars.

Fourth, that a tremendous financial burden has been placed on all of us due to the necessity of increasing, as well as maintaining water supplies and their distributing systems for fighting fires, fire departments, the actual fighting of fire and other contingencies.

Fifth, that fire insurance does not re-create one single thing destroyed by fire, but merely serves as a means of collecting money from all of us in the form of premiums to reimburse those whose property is destroyed by fire.

The way out of all this trouble is quite simple; namely, prevent fires. We have been told many times that they are largely preventable and those causes which cannot be eliminated can be surrounded with such safeguards that when the fire does occur it can do little or no damage. Coupled with this is the statement that the majority of the fires, causing such devastation and life loss, result from carelessness and ignorance. Neither of these statements brings us very close to a practical solution.

When a manufacturer is faced with similar problems, such as loss in production or business; non-uniformity in quality of products, power losses, heavy labor turnover and like questions, he at once makes a most detailed analysis of plant conditions, materials, processes, machinery and even personnel to ascertain the cause. Now the manufacturer fully ap-

preciates that the success of his business depends upon eliminating or remedying the defects which are uncovered, and common sense dictates that immediate action be taken.

Why cannot we apply the same sound business principle to our fire waste problem? The most authentic fire cause statistics available today are those published by the National Board of Fire Underwriters, as compiled by its Actuarial Bureau. Analyzing the 1923 tabulation which appears in the January, 1925, issue of *Safeguarding America Against Fire,* we find that with an estimated loss amounting to $535,372,782 for the year 1923, six known fire causes resulted in twice the amount of loss of all of the remaining known cause fire losses.

Listed in order of amount of loss, the one to which the largest loss is attributed placed first, results in the following:

First—Matches and Smoking.
Second—Defective Chimneys and Flues.
Third—Stoves, Furnaces, Boilers and Their Pipes.
Fourth—Spontaneous Combustion.
Fifth—Sparks on Roofs.
Sixth—Electricity.

Exposure and conflagration losses are not included in the analysis of losses resulting from known fire causes as they are an effect rather than a cause. Furthermore, the losses listed under the heading "Unknown Causes—probably largely preventable"—are also left out, although if the origin of these fires were known it is unlikely that they would change the relative importance of the known causes.

Checking the 1923 losses against 1922 we find that the causes just given were the first six causes which resulted in the greater portion of the 1922 fire loss.

Thus we find that one-third of the known causes of fires as compiled by the underwriters result in two-thirds of the total fire loss and that there is nothing mysterious about these causes.

There are, of course, many contributing factors besides the actual fire causes which have a definite bearing on the amount of loss, such as poor types of building construction, lack of vertical and horizontal cut-offs or protection against exposure, deficient fire protection or none at all, poor housekeeping, etc.

One might argue that if proper conditions were maintained the loss would be greatly lessened without worrying about fire hazards—very true, but is this the right answer? Fundamentally, if we could eliminate the causes of fires, all of the contributory loss factors could be forgotten. While the latter thought is perhaps too Utopian at the present time to be entirely practical, cause should receive first consideration, and effect, second.

The manufacturer who appreciates what a fire in his plant may mean, not only in the destruction of his property, but in loss of business, profits, prestige and other things which fire insurance does not cover, gives careful attention, first, to the question of fire hazards, both common and process, and second, to the contributory loss factors just mentioned.

He furthermore watches his fire record or fire frequency very closely and any indication of fire outbreak from any cause is immediately investigated. For example, a large corporation some years ago found that fires of electrical origin were becoming too frequent. An analysis of some five hundred fires occurring during the war period showed that 46% were due to defective maintenance of equipment; 29% defective installation; 19% careless operation, and that only 6% could be placed in the so-called "unpreventable" class. The steps to be taken were quite obvious and needless to say the number of fires from electrical causes have been reduced to a minimum. Would it be practical to follow this procedure as regards our national problem of fire loss?

I sometimes wonder if we do not delay bringing about the results which we are after, by scattering our efforts instead of concentrating on the conditions or things which produce the major portion of the total loss. May it not be that our fire prevention activities are too broad and our programs too long? Several persons have stated to me that when they get into the fire prevention problem there are so many angles or phases, so much to be done, that it brings about a feeling of helplessness and confusion, yet upon analysis we find that there are six commonplace, ordinary, everyday hazards which cause two-thirds of the loss. Suppose for one year we devoted our entire efforts to eliminating or safeguarding the hazards which have already been mentioned; bringing about a permanent improvement, and the year following add those which further analysis shows to be the most serious. Is it not entirely possible that immediate reduction in the fire losses would result and that in a very few years we would accomplish far more than in trying to improve the whole problem to some slight degree?

The country's manufacturers have a vital interest in fire prevention work. Most of the things which cause fires through misuse, either carelessly or ignorantly, are the product of industry. The success of any industry depends upon the continued demand for its output. Hence, manufacturers who are alert and looking to the future, welcome reasonable, sensible and just regulations, even affecting the conditions under which their products are manufactured, as well as used. Knowing the hazards of their products they gladly co-operate with regulatory bodies in drafting such measures. This has been evidenced by the handling of the model motion picture film bill even though the fire record, which is a

more or less true measure of the hazard, does not warrant such action when compared to the constantly recurring losses from the six causes mentioned. The manufacturers, however, realized that there were inherent fire loss possibilities which might well be safeguarded.

Everyone admits that matches are a necessity of life. Improper use and carelessness, it is alleged, cause many fires and a distressing amount of child life loss. If left to the manufacturers, I do not believe that they would sanction for one second the improper and careless use of matches or that they feel that matches so used increase their sales or profits. The oil interests are concerned about unnecessary loss of property and life due to improper and careless use of oils and have done much to correct this situation. Co-operation on the part of gas manufacturers has accomplished results in reducing fires from that cause.

If tobacco smokers were brought to a point through education or otherwise where they would extinguish the cigarette, cigar butt or pipe ashes, before carelessly throwing them down, or would put them in a safe place, just as much tobacco would be used under such conditions as is used today and the country would be much safer. Why should not the manufacturers of smoking materials welcome measures which will educate people to use their products carefully without endangering their own property or the property of others? On the other hand, we may well appreciate that if the manufacturers do not understand the situation, and have an inborn fear and dread of unjust and impractical legislation or regulation, they will hesitate to assist in the fire prevention activities, for they will believe that by so doing they are hindering their own growth and success. Knowing something about the country's fire record they cannot understand why their processes or product should be singled out for regulation when so little is apparently being done to control the hazards which are causing nearly all the loss. This is a natural position for industry to take, and unnecessary, unreasonable or impractical restrictions only prejudice their feelings against actively supporting the fire prevention movement.

Perhaps I can best explain what I mean by telling of a little experience which I had several months ago. I was discussing the use of an unapproved device with one of our very prominent fire insurance engineers. During conversation he said, "We know that such devices are being installed, but let one serious fire occur or let there be loss of life, and see how quickly it will be stopped." I said, "Were there many fires in your city last winter due to the use of combustible receptacles for ashes?" He said, "A good many, and everything from soap boxes to peach baskets is being used." Here is a man vitally interested in the prevention of fires who personally knew that very little, if anything, was

being done towards eliminating the combustible container for ashes, but was up on his toes waiting for a fire from what was said to be an unapproved device, so that immediate and drastic action could be taken to eliminate or safeguard this particular fire cause, which thus far has had a good record.

The people of our country must be educated in fire prevention. Perhaps the best way of enforcing or accelerating education as far as the fire loss problem is concerned, is by means of the personal liability law. There is nothing new in this thought. Many European countries already have such laws. It is a somewhat back-handed way of attacking the problem, working as it does from effect back to cause. However, it would impress on the careless and indifferent person his responsibility in this national problem. When interest is once aroused educational work will be much easier.

The thoughts which I wish to emphasize are:

First, make a thorough analysis of the causes of fires and the contributory loss factors.

Second, concentrate on those causes and factors which are responsible for the greatest portion of the loss.

The very casual analysis here presented indicates that six causes out of twenty, or slightly less than one-third, result in two-thirds or more of the total loss.

I feel confident that when industry understands that our fire prevention activities are on a practical and sound basis, it will co-operate to the fullest extent.

Fun Learning Fire Prevention.

Fire prevention is a subject given more than ordinary attention in instruction to boy and girl scouts. For instance, a Girl Scout must have a pretty good knowledge of the subject before being promoted from a "tenderfoot" to a second-class scout. A Hamilton, Ohio, troop of Girl Scouts got their instruction recently through the courtesy of an officer of the fire department, and had a lot of fun in the process.

Inviting the troop to his fire station, the officer gave them a talk on fire prevention and then showed them around and explained details of the station and equipment. He demonstrated how to turn in an alarm, showed them how it was received, and allowed them to send in an alarm themselves in response to which he staged a special run of his apparatus.

The girls were allowed to try sliding down the pole, jumping into a life net, and as a final thrill were "rescued" from a burning building by the firemen.

Record Protection, A Credit Asset.

By W. W. Orr.

Assistant Secretary, National Association of Credit Men. (Member N. F. P. A.)

Recent figures compiled by industrial research afford food for thought to all business men, and particularly credit men. We are all aware of America's stupendous fire loss in buildings and property—today the economic shame of the continent. Admirable as it is, our rapidly growing fire prevention movement in thirty years has not been able to forestall the ever mounting losses of this Red Plague.

But we overlook another similar and equally serious form of loss—the penalty and handicap of burned business records. Newer by fifteen years than the fire prevention movement, the present record protection movement is gaining headway and becoming as important as its elder brother.

We have always known that "records are valuable," but American business today has a new realization of such value, and a great movement has sprung up around this recognition.

Records of today are different from those of even a few decades ago. They are more complete in detail because of our more intricate transactions and need for more detailed written memories. Increased number of transactions and need for information has made for much greater bulk. They differ in form because the simple methods which served our grandfathers well cannot meet today's complex needs.

But they do not differ materially in function. Piece by piece they are more valuable than were the corresponding records of fifty years ago.

But even a progressive people such as we claim to be, and are, seems to follow the groove of established practice. While we believe that "records are valuable," we base our conclusions as to which records are valuable to too great an extent upon familiar appearance and traditional importance.

We still protect our ledgers, mere recapitulations of totals, in themselves proving nothing. We guard our legal papers and insurance policies, although today either may be easily and dependably duplicated.

If sales slips were still originally entered in an old-fashioned "day book" no doubt we would find room in the safe for that book. If original invoices were still pasted into a bit of a scrap-book, we would attach a

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Reprinted from *Credit Monthly*, official bulletin of National Association of Credit Men. (Member N. F. P. A.)

value to that book. If we still squeezed out wet rags in order to make copies of our letters in a tissue book, that book would be one of our prized possessions.

These records, more necessary than ever, do not resemble in *appearance* those which custom says should be protected. So we leave sales slips and charge sheets in drawers, in loose leaf binders on shelves, or in flimsy containers. Our original invoices we put in wood or steel files to burn up in even an incipient fire. Our letters and "files" are so voluminous that safe room is out of the question. We regard them as "of little value anyway" or else trust thin, uninsulated steel to protect them.

A great many people still think one safe enough for any office. Whatever records find no room in it are valueless and "wouldn't matter if they did burn up."

American business, startling the world with its marvelous development, demands more and better records, depending on them for continuing progress. Yet—at least until our recent awakening—we have protected a far smaller percentage of our valuable records than did the more elemental businesses of half a century ago. In the case of many individual firms this deplorable condition is still entirely true.

The inevitable question occurs: "If these new records are valuable why have not their values been fully recognized after the many fires of recent years, in which many of them must have been destroyed?" The answer is regrettable but simple.

There have been many individual losses, usually entirely conclusive to the firms affected. So conclusive, in fact, that they seldom will disclose the total extent of their record losses.

There are three principal reasons for this:

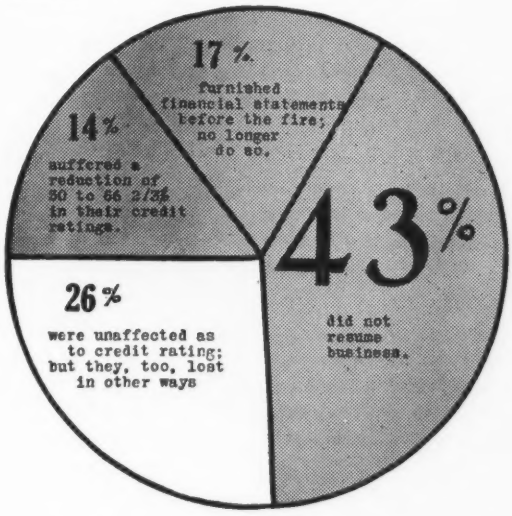
(1) They feel that if the loss of their records is not known, they can avoid many of the troubles which are clearly forecast by the first few "after the fire" experiences.

(2) Loss of records through insufficient protection implies a carelessness no one would care to admit.

(3) There is no interested party,—such as insurance companies become in insurable losses,—to whom facts *must* be disclosed. Records cannot practically be covered by the insurance policy.

These three reasons have deterred the general spread of knowledge as to the amount of fire losses of records and the handicaps resulting from them. Some firms, however, have told their stories to help others. Gradually enough has become known to awaken progressive business and make proper protection of all records one of the livest topics in business economics today.

The activities of the N. F. P. A. and such organizations as the National Electric Light Association and the National Retail Dry Goods Association, which have made studies, given convention time and printed reports upon the subject, as related to their crafts, are unmistakable evidence of the now recognized importance of the movement. The thousands of individual businesses analyzing their own situations, calling in trained experts for technical phases, are spreading the idea of efficient protection for today's records.


17 %
furnished financial statements before the fire; no longer do so.
14 %
suffered a reduction of 50 to 66 2/3% in their credit ratings.
43%
did not resume business.
26 %
were unaffected as to credit rating; but they, too, lost in other ways

Effect of Fires on the Credit of 100 Concerns.

Record protection has indeed become almost a science. To be fully effective it must be combined with convenience, efficiency and economy. The proper balance of these factors presents complexities. Experts must be schooled in the values of each record, probabilities of fire, office efficiency and arrangement, and conversant with all the various devices used in record housing.

The research organization of the Safe-Cabinet Co. (Member N. F. P. A.) has supplied the figures given in the chart herewith. They show in a broad way the effect of destroyed records on business, and the results indicated are overwhelmingly conclusive as to the propriety and importance of the present record protection crusade.

The figures were obtained by selecting, entirely at random, one hundred cases from the fire and record loss file of their research laboratory. A careful questionnaire was prepared and submitted to R. G. Dun Com-

pany for compilation of credit histories from five years before the fire to the present time. On completion of this investigation, files were sent to the company in each location affected, for checking and any added information.

The few unrated professional men and others upon whom there were not sufficient dependable data were eliminated.

The fire and record losses covered by this cross section analysis occurred between 1915 and 1922. They involved a broad range of business from a 2½ million dollar manufacturer to the merest crossroads store.

The question arises as to factors other than record loss entering into these figures. A study of details of this and other investigations shows that other factors were minor. A few cases of serious under-insurance were shown. But the great lesson was one of inability to collect outstanding accounts, to completely prove loss for insurance collection and to resume business quickly without records.

Almost half of these firms either failed to resume business or were out of business within six months. Seventy-four per cent of them suffered serious or fatal red ink entries against their credit.

The inescapable conclusion to be drawn from these facts is that no business can afford to take such a risk, and that every business may well look immediately into its own record protection situation.

But the recognition of the importance of record protection is not entirely new to credit executives. Many manufacturers, wholesalers and their associations have realized the jeopardy to their customers' businesses by improper protection. Realization has not been as complete as facts would seem to warrant, but definite steps have been taken and results already obtained.

For the purpose of understanding how little the asset value of records is generally appreciated, let us analyze the commonly accepted form of "financial statement" which is today used as a primary basis for arriving at proper credit extensions.

Uninsurable, Flammable Assets.

Under "Active Business Assets" the "standard form B" endorsed by the National Association of Credit Men lists as the first asset, "Value of Merchandise on hand at cost." The second item is "Notes and Accounts." Obviously, these accounts and pieces of paper are assets. They run anywhere from 20 to 50 per cent. of the total assets of an average business.

The second asset, "Notes and Accounts," is a considerable part of total assets. *It is the most flammable* of all assets. It is not insurable in any practical way.

On the opposite side of this property statement the following questions are asked. "Amount of insurance on stock? On fixtures, ma-

chinery, horses and wagons? On real estate?" These are very proper questions, probably vital to asset number one being actually an asset. But how about asset number two, "Notes and Accounts"? What information is asked as to its safeguards? None.

Yet the history of fire-destroyed notes and accounts is one of the losses running usually from 20 to 50 per cent of the total losses, hence a dangerous peril to credit.

Under-insurance of buildings and stock means either buying adequate insurance or decreased confidence in ability to pay in case of fire. Why should not insufficient protection for "notes and accounts" also mean securing proper protection for them as a result of lessened credit worth?

Farther down the page we find "How often do you take an inventory of stock?" "Date of last inventory?" and "What books of account do you keep?" But not one word about "How do you *protect* that inventory?" "How could you bring your last inventory up to date in case of fire?" or "What books of account do you keep protected?"

Thus even asset number one is endangered. For collection of insurance is not dependent upon taking an inventory, its date, or what books are "kept." It depends upon having that inventory up to date after fire has perhaps swept all other visual evidence away.

Inventories in ashes are of no value to insured or insurance company. Inventories made months before a fire are of little value except as a starting point. Invoices for goods purchased must be added. Goods sold, as shown in original sales records, must be deducted to give an inventory as of the day of fire.

Books of account, without original entries from which they were made, prove nothing. Insurance policies specifically state that insurance does not cover "accounts, bills, currency, deeds, evidences of debt, money, notes or securities." They definitely state that the insured shall "make a complete inventory of the damaged and undamaged property stating the quantity and cost of each article." Also that insured shall "produce for examination all books of accounts, bills, invoices and other vouchers, or certified copies if the originals be lost."

The provisions of insurance contracts carry no equivocation. Insurance is a reputable industry. Failure to properly collect insurance reduces assets and affects credits. But this is not the fault of the companies or the insurance contract. Yet uncollected insurance puts good accounts out of business or makes them slow and uncertain in payments.

The average jobber or factory is in a position to offer, and usually gladly gives, wholesome counsel on business matters to its customers. Would it not be good business for firms to advise with their clients on this new subject, from both an altruistic and selfish point of view?

America has a fire a minute, with an average loss of a thousand dollars in tangible property. The loss due to burned records is frequently estimated to equal, if not exceed, this property loss. A portion of tangible loss and practically all record loss occurs in business fires. All these destroy values in some form, reflecting on solvency and credit worth.

The largest manufacturers of men's clothing in the world have written their thousands of merchant patrons urging them to protect their records. The Arkansas Wholesale Grocers' Association sent a bulletin to all members, along these lines. The Dakota Iron Store, wholesale hardware dealers of Sioux Falls, S. D., addressed all their salesmen telling of some losses they had just suffered due to loss of customers' records and advising them to get their customers to keep their records in safes. The Wholesalers' Association of Tacoma, Wash., sent out a protective letter to merchants buying goods from any member of the Association.

These forward-looking efforts of firms and associations indicate the trend of the times. They have proven worth while to their sponsors. Similar steps by all who extend large credits would exert a force which could largely and quickly eliminate such losses. One loss avoided would compensate many times for the cost of such activity.

To make such work most effective, credit executives should not recommend to their customers "any old" protection. They should not be misguided by the misleading word "fireproof." Record containers, files, desks, and charge slip systems are sold today on certification as to their various degrees of protection, and safes and vault doors are obtainable in certified and labeled grades of resistance to fire and heat.

Record protective devices are most economically and efficiently bought today on a basis of proven need, as established by actual survey of each particular situation. Such analyses are obtainable without cost. Safe keeping products should not be sold only on the basis of their fitness to the particular problem involved.

The record protection movement, while comparatively young, is rapidly reaching maturity because of the tremendous value now being disclosed and realized. Its importance to credit men is obviously exceeded only by its importance to firms who may themselves lose their records.

A New Film Fancy.

It cannot be said that all movie films leave a pleasant taste in the mouth, or are all of them safe for the public!

After such an introduction one might fear we were about to complain about the artistic or moral worth of some recent Hollywood production. Not at all! We have said movie film and we mean movie film, not moving pictures. It happened in Mexico and the inventive genius who overreached himself was a Japanese —all of which may sound confused. It really is very simple.

A Jap dwelling in the Mexican state of Campeche thought to "buck" the chewing gum magnates by putting in a small gum factory of his own. Mexico, as you know, is a large producer of chicle, the basic gum of the everlasting chew. But the price of that resin, due to the enormous gum-hunger of American flappers, was too high for profit under the somewhat crude manufacturing methods of the Nipponese innovator. The Jap, however, had business relations with a local film exchange at a town that appears to have been at the end of the circuit. When films had gone every place else imaginable and had been cut and repaired and worn and discolored to the limit, they halted at Campeche as their final resting place—they weren't even worth paying freight on to another stop.

However, the experimental Jap found that by cutting up and boiling the defunct films it was possible to obtain a pulp that would, when mixed with a small amount of chicle, give a fair imitation of the famous wiggly product.

All was well with the Jap's world until the other day, in a thoughtless moment, the manufacturer lit his pipe and placed the match end upon a shipment of his home-brew chiclets.

It will be remembered that movie film is a close cousin to nitroglycerine. At last accounts not a trace had been found of either the Jap or his plant. It is therefore too late now to ascertain whether or not the nature of the scenes depicted on the film affected the taste of the gum. We have seen some photoplays that have seemed strong enough to do so.

—Editorial from the New Orleans *Times-Picayune*.

Courtesy *Fireman's Fund Record.*

The San Francisco Chamber of Commerce office fire, August 2, 1925. (See report opposite.)

San Francisco Chamber of Commerce Fire.

Report by A. D. Lange.

Fireman's Fund Insurance Company. (Member N. F. P. A.)

The accompanying illustration shows the results of a fire in the offices of the San Francisco Chamber of Commerce, on the tenth floor of the Merchants' Exchange Building, discovered Sunday morning, August 2, 1925. Supposedly caused by a carelessly thrown match, it smouldered for some hours before bursting into flame. The fire was soon brought under control, being confined to the offices of the Chamber of Commerce.

The interesting features of this fire are the loss of records and behavior of filing equipment. The photograph shows that the fire was not of sufficient severity to consume light woodwork, being extinguished after the surface of the wood had become well ignited, but before it had burned through.

The light steel files proved no more protection to their contents in this particular fire than did the wooden files. After the fire an inspection of the contents of some of the files showed, surprisingly enough, that while papers contained in wooden files were slightly scorched around the edges, they were still legible, whereas those contained in steel files seemed to have been baked clear through so that they were crisp and brown. It is reported that there was less loss on the files, themselves, in the case of steel than with the wooden equipment. A number of the steel files were re-conditioned and are now in use again in their offices, whereas the wooden files were a total loss.

It was possible to re-condition most of the desks and one adding machine. Two typewriters were a total loss, whereas some fourteen others were traded in on new machines with a reasonable allowance for damage.

The direct fire loss, covered by insurance, was about $5,000. The record loss was estimated to be about an equal amount. The original data was not destroyed, being largely obtainable from partially destroyed records that were still legible. In order to transcribe records on to new forms, however, an additional clerical force had to be hired and it is estimated that the cost of the work, including labor and supplies, amounts to $5,000, this making the total fire damage $10,000.

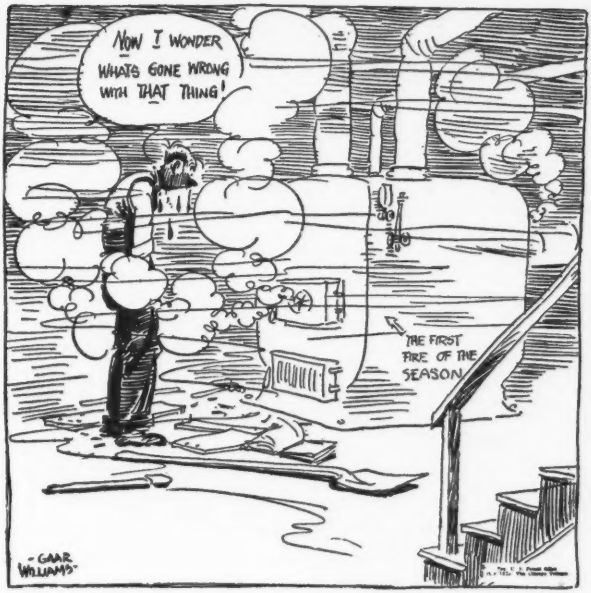
Care of Domestic Oil Burners.

By E. J. Smith.
(Member N. F. P. A.)

At this season of the year in many territories oil burners have already been called into service, in others they soon will be. In either case it is not too late to take the time to see that everything is ship-shape for the winter's heating demands.

Many of the following suggestions are not peculiar to oil burners alone, and it should not be assumed that heating plants using solid fuels may safely receive less care than those using liquid fuels. General interest on the part of the householder in his heating plant, be the fuel what it may, will without doubt be of material aid in reducing fire losses. To the general reader statistics make dry reading, but it may be well to point out here that the data compiled by the National Board of Fire Underwriters through its Actuarial Bureau show that three of the causes of fires which may be chargeable to lack of proper attention to heating plant construction and maintenance are increasing their toll on the public purse. Defective chimneys and flues, sparks on roofs, and stoves, furnaces, boilers and their pipes caused a loss from fire in 1923 of $55,417,852 as compared to $47,102,936 in 1922; an increase of $8,314,816. This increase is due to the continued carelessness of the public and not to any change in methods of heating. In spite of the publicity given to proper chimney construction and heater installation, faulty chimneys are still being built, and heaters and furnaces are being so installed as, in due course, to add to the fire loss record. Without belittling the results to follow careful attention to the maintenance of domestic oil burners, it may safely be said that unless users of all types of heating plants give equal attention to safety from fire, no material reduction in total losses due to heating plants may be expected.

The general attitude of the householder is to wait until trouble is experienced and the longer a device or equipment will perform its duties without attention, the more likely is he to put off the check-up needed by any device upon which he depends for comfort and health. "A stitch in time" applies to all heating plants, and even though you may have been perfectly satisfied with last year's supply of heat, get busy now and assure yourself that you have the same experience in prospect for this coming year. Many of us are inclined to "Let George do it"; to those we say it would be preferable to have the oil burner service man attend to the conditioning of oil burners. If you must do it yourself or should you



Courtesy *Chicago Tribune.*

desire to check up on the work of the service man, see that the following items have been properly attended to:

Read manufacturer's directions for the care of the heating plant and of the oil burner.

Clean chimney and be sure that the lining is in good condition.

Clean smoke pipe and be sure that there are no openings into the basement. Defective sections must be replaced.

Clean heater and be sure, while doing so, that oil burner parts are so covered as to prevent scale or dirt from getting into burner passages.

Check tightness of combustion chamber and be sure, in the case of cast-iron hot-air furnaces, that the joints between the sections are properly cemented.

Clean burner and when doing so, be sure to follow manufacturer's directions.

Clean overflow lines from burner, if any, and be sure to test anti-flooding device by slowly pouring a small quantity of oil into the burner near overflow inlet.

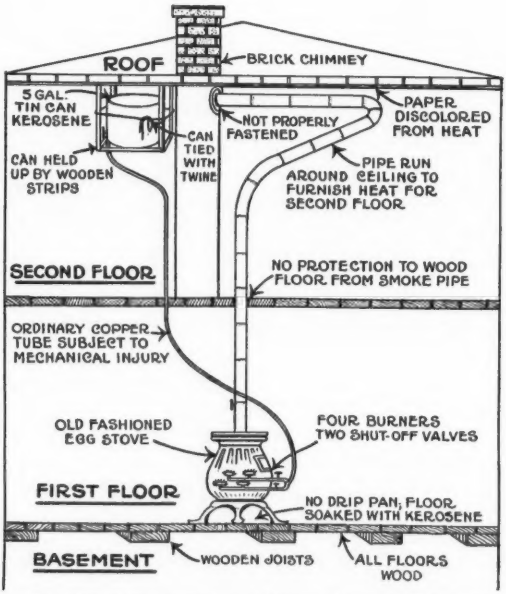
Clean strainer in oil supply line and when replacing cover, be sure that you have made the joint tight.

Examine all pipe lines and in case of noticeable leakage be sure that joints are properly tightened.

Examine tank or other vent outlets and be sure that openings are unobstructed and that the vent is clear.

When ordering oil be sure to advise the oil dealer of the name of your burner, and to request him to furnish the type of oil specified by the burner manufacturer.

Read manufacturer's directions for starting the burner and be sure that everything is in order, before the real need for heat, by making a trial run. Many a hurry call for help during a sudden cold snap can be avoided by "the stitch in time."


ROOF
BRICK CHIMNEY
5 GAL. TIN CAN KEROSENE
CAN HELD UP BY WOODEN STRIPS
CAN TIED WITH TWINE
NOT PROPERLY FASTENED
PAPER DISCOLORED FROM HEAT
PIPE RUN AROUND CEILING TO FURNISH HEAT FOR SECOND FLOOR
SECOND FLOOR
NO PROTECTION TO WOOD FLOOR FROM SMOKE PIPE
ORDINARY COPPER TUBE SUBJECT TO MECHANICAL INJURY
OLD FASHIONED EGG STOVE
FOUR BURNERS TWO SHUT-OFF VALVES
FIRST FLOOR
NO DRIP PAN, FLOOR SOAKED WITH KEROSENE
BASEMENT
WOODEN JOISTS
ALL FLOORS WOOD

This drawing, reproduced from the 1925 Fire Prevention Year Book, published by the Baltimore Underwriter and National Agent, shows a curious home made oil burning outfit discovered during the course of a fire prevention inspection. This installation was contrived by an inventive Italian. He had managed to heat two floors of his home in this manner, and, by some strange freak of fate, had not had a fire.

Oil Burning Torches.

By R. O. Matson.

Underwriters' Laboratories (Member N. F. P. A.).

A recent fire in a railroad round house, originating from the use of a pressure type oil burning locomotive lighter, is illustrative of the fire hazard involved in the use of the type of oil burning equipment in common use on railroad property today. This article is written in the endeavor to point out the fire hazards involved in the use of such equipment and to indicate wherein the use of improved oil burning devices on the market will materially reduce the inherent hazards of this class of devices.

The apparatus, which either directly or indirectly was responsible for the origin of this fire and which contributed materially to its spread, was a home-made device, and consisted essentially of a 20 gallon steel oil supply tank, a nozzle or burner, and an air and an oil hose. The steel tank was mounted on a two wheel truck, making the unit a portable outfit. The nozzle was constructed of iron pipe and fittings, and consisted of an air line and an oil line which were connected at the burner end, and each of which contained a control valve at the inlet end. The oil hose extended from a connection at the base of the supply tank to the oil line of the nozzle; the air hose from a connection on the top of the oil tank to the air line of the nozzle. The air connection on the top of the oil supply tank was connected to a house air line under a pressure of 100 lbs. per sq. in., resulting in a like pressure in the entire equipment.

When this type of a lighter is used, the locomotive grates are covered with coal and a house steam line is connected to the engine blower. A piece of oily waste is ignited and thrown into the fire box. The burner end of the nozzle is then inserted in the fire box, the air valve opened, and then the oil valve. The lighter flame ignites the coal in about ten minutes.

It was reported that in the course of the lighting process, during which this fire started, a blast of flame shot from the fire box severely burning the operator who was in the engine cab, and that shortly after the oil hose failed, resulting in the discharge of the contents of the oil supply tank into the fire. The blast of flame was explained as being a back flash resulting from the failure of the operator to provide sufficient draft to carry the products of combustion out of the fire box. Further, it is thought that the back flash carried with it into the cab such oil as had accumulated in the fire box as a result of incomplete combustion of the oil spray from the lighter nozzle. The flames from this burning oil in the cab obviously

brought about the failure of the oil hose which discharged the contents of the oil supply tank into the fire, increasing its intensity and resulting in rapid spread of the flames. It would appear, therefore, that the lighter was first instrumental in causing this fire and then contributed materially to its spread.

It is obvious that such shop-made equipment involving oil under pressure and not provided with a specially designed burner to insure proper combustion of the oil spray, presents a serious fire hazard. The use of shop-made oil burning equipment, which has not been designed with the inherent hazards of the class of equipment in mind, and which is not constructed of materials especially suitable for the purpose used, is a practice which should be discouraged. Home-made equipment is too often made up of available stock in such a manner as to merely accomplish the immediate end for which it is intended and without the proper study and consideration of the fire hazards involved and of the service conditions to which it may be subjected. A burner which is not specially designed to permit proper combustion and to prevent the loss of oil is an inferior device, and is not suitable for use on oil burning equipment. It is very doubtful whether the occurrence of the back flash described above would have resulted in an unfriendly fire if the burner had been properly designed to prevent the accumulation of oil in the fire box. The practice of employing oil under pressure in equipment of this kind is one which involves an inherent hazard, because of the great danger of damage resulting in a break in the oil container or oil lines, and in the consequent discharge of the entire oil content of the equipment under pressure. Regardless of how the above fire started or how the oil hose failed, there is no question but that the oil remaining in the supply tank at the time was discharged from the break in the oil hose due to the fact that it was under pressure.

There are now on the market improved oil burning torches intended for locomotive lighting purposes among various other uses, which do not involve the objectionable features mentioned above, and consequently are recognized as involving considerably less fire hazard than the type of lighter in general use. These are substantially constructed portable devices, designed to withstand the wear and tear of service conditions for a reasonable length of time, and manufactured in accordance with standard practice for this type of oil burning equipment. They consist essentially of an oil supply tank mounted on a two wheel carriage, a specially designed burner to insure proper combustion of the oil spray, an oil hose conveying oil from the tank to the burner, and an air hose connected to the burner. The oil is drawn from the tank to the burner by the aspirating effect of air under pressure passing through the burner. The oil

supply tank and the oil hose are not under pressure at any time. The oil tank is provided with a vent to the atmosphere which is normally open, but which is provided with a ball check valve which is intended to close in the event of overturning of the tank, thereby preventing the escape of oil.

Assuming that such a torch had been employed instead of the lighter that was in use, when the fire described above occurred, what would have been the probable results? In the first place, oil would not have been thrown from the fire box into the cab by the back flash, due to the fact that proper combustion of the oil spray would have prevented the accumulation of oil in the fire box. Further, in the event of a break in the oil hose, resulting from whatever cause, the only oil that could possibly be discharged would have been that contained in the upper portion of the hose, the remainder flowing back to the tank by gravity.

These torches are not restricted in their use to locomotive lighting, but are intended for general use in railroad and car shops and industrial plants where there is a need for portable preheating devices. They produce an intense flame which make them especially suitable for preheating heavy metal parts preparatory to cutting or welding operations.

Penalizing Carelessness.

The *Hartford Agent* calls attention to the following story from the Montreal *Star*, of a court decision that is of interest from a fire prevention viewpoint. The *Star* item reads:

"By judgment of Mr. Justice Martineau rendered this morning in Superior Court, Jos. A. Jodoin, road contractor, was ordered to pay R. Reid, of Boucherville, $1,500 damages for the loss of his factory destroyed by fire June 22, 1921.

"Reid stated that he owned a cheese and butter factory which had been frequented by the contractor's men while they were doing road work. The men used to draw water there, he said, and on the day in question, the place caught fire. He attributed the accident to carelessness, and stated that the men had either smoked around the place or that sparks from the cement mixing machine had caused the outbreak.

"The court held that the defendant had failed to establish freedom from responsibility and adjudged against him."

Captain Conway, Fire Preventionist.

By Ralph Richman (Member N. F. P. A.).
Editor, Fire Protection

A simple recitation of the facts proclaims J. J. Conway, superintendent of the Cincinnati Salvage Corps, one of the outstanding characters in the field of fire control.

Until 1906, fire losses in Cincinnati were going steadily upward. The first act of Cincinnati to save itself from this condition was the passage of a real building code. After seven years of preliminary work, support of the Chamber of Commerce was obtained and the facts about fire losses were taken to the people. In 1912, the Cincinnati Fire Department began to do inspection work; in 1915, a separate Fire Prevention Bureau was established in the Cincinnati Fire Department. The method of carrying on this work in Cincinnati became a standard for many other cities. These were the high spots in a program of improvement.

Between 1906, when insurance schedule rating was introduced in Cincinnati, and 1910, substantial reductions were made in insurance rates. Further reductions followed in 1914 and in 1917 on brick buildings and contents so that the total reduction from 1910 totaled 31 per cent on buildings and 32 per cent on contents. Marked reductions were also made in rates for frame buildings. The consequence of fire prevention work was a saving in insurance premiums to Cincinnati citizens of more than $850,000 a year or an amount greater than the city was expending for maintenance of the fire department. For a period of years, the number of fires decreased while the city was growing.

Those are the facts. Now the Captain would be the first to point out all the various factors, organizations, officials and citizens making up the reasons for success in Cincinnati. Everyone acknowledges though that it was the leadership of Captain Conway, more than anything else, that brought all forces to function toward results.

The story of the achievement is short. But it takes no account of the thousands of personal interviews with leading citizens of Cincinnati; it takes no account of the hundreds of addresses in factories, in schools and before every kind of organized group in the city; it takes no account of the time spent in devising and maintaining fire facts to provide convincing evidence; it takes no account of many hours of labor, of which the public has never known, devoted to work which he believed to be for the public welfare; it takes no account of the thousands of fire alarms answered and the energy expended in direct conflict with fire itself.

J. J. Conway.

The Captain's influence has gone far beyond his native city. As a representative of the National Board of Fire Underwriters he has established new salvage corps and put new life into old ones. As a popular and effective speaker upon fire prevention, he has addressed conventions in all parts of the United States and Canada. The story of his work in Cincinnati has been an inspiration to thousands.

But what of the man himself? Big in stature and body, even among big men; likely to seem a little brusque upon first acquaintance, but carrying a heart filled with human understanding and sympathy, the Captain becomes a vivid personality wherever he appears. When he couples with this personality an unmatched knowledge of fire prevention gained from forty years of study, personal experience and observation, he is one of the few men in the country, if not the only one, who can talk on the subject of fire prevention before an audience for an hour and have it calling for more.

There are many men in the field of fire prevention who can talk with great interest on some single phase of their subject, as, for instance, upon the subject of the public's relation to fire prevention, building construction, investigation of incendiary fires, fire extinguishing operations, automatic sprinklers, insurance protection and salvage corps operations. But there are very few who can speak interestingly and with value to the listener upon two or more of these phases of fire prevention. Yet Captain Conway, without having had the educational facilities of which he has been proud to see his own children take advantage, can talk upon any of these subjects and bring to all of them the results of original thought and personal conclusions.

Captain Conway has reached his position of leadership by reason of a seemingly inexhaustible fund of energy and enthusiasm, extraordinarily marked mental powers and an earnestness which removes any personal sting from his most bitter and sarcastic remarks when discussing his favorite subject of fire prevention.

It would be fair to say of this man that he has done more than any other man in this country to show the possibilities of loss reduction in municipal fire prevention efforts.

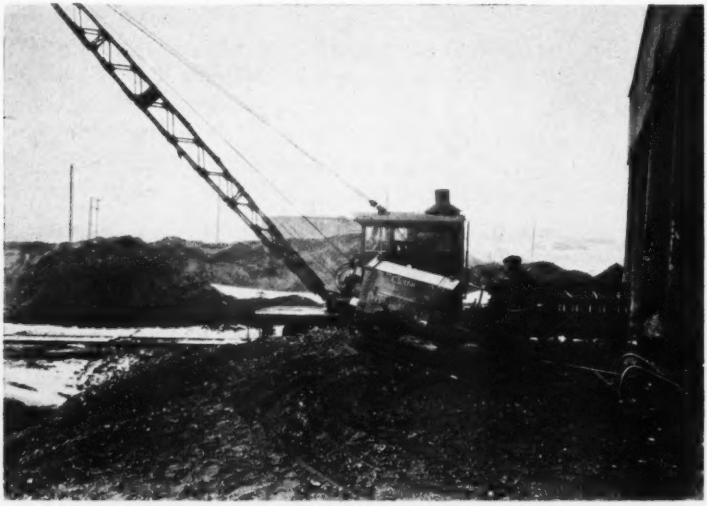
Preventing Fires in Coal Piles.

By Inspection Department, Associated Factory Mutual Fire Insurance Companies.

(Member N. F. P. A.)

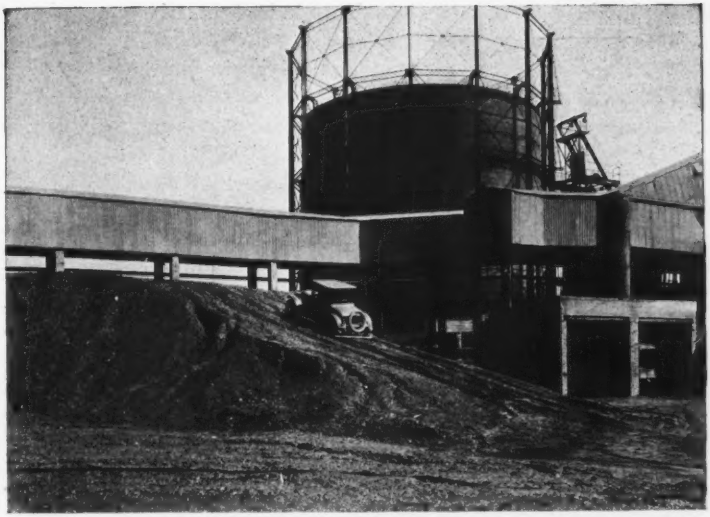
Coal-pile fires almost continuously for twenty years and now no fires for twenty-one months! From a shrinkage of ten to fifteen per cent to no loss whatever in a 10,000-ton pile! This was the result of adopting the packing and rolling method of piling coal at the Utica Gas and Electric Co., Utica, N. Y. No change whatever has been made in the quality of coal purchased. It contains from 68 to 78 per cent of carbon, from 1 to 1.45 per cent sulphur, and has a heating value of 13,250 to 14,500 B.t.u.'s.

The accompanying pictures show the coal pile and the method of piling. The coal is dropped from a bucket crane in layers about three feet deep, and is then smoothed and packed down by a caterpillar tractor hauling an ordinary road drag. The coal is tamped down with a mallet around posts or other projections extending up through the pile. Succes-



Method of smoothing and packing coal pile. Coal is dropped from a bucket crane in 3 foot layers and then leveled and compacted by tractor and road drag. Successive layers are added until the pile is 20 feet high.

Reprinted from the *Factory Mutual Record*, published by the Inspection Department, Associated Factory Mutual Fire Insurance Companies.



Coal pile at the Utica Gas and Electric Company, stored by packing and rolling process to exclude air and prevent heating. The surface is hard enough to permit driving an automobile on it. No fires have occurred in 21 months in a 10,000 ton pile.

sive layers are then added in a similar manner until the coal reaches a height of 15 or 20 feet. This may be increased to 30 feet where storage space is limited.

The principle is to pack the coal tightly and exclude the air. As shown in the picture the surface of the pile is so hard that an automobile can be driven up on it. The caterpillar tractor weighs about 3800 pounds and is economical to operate. The cost of leveling and rolling is about six cents per ton. The increase in storage capacity is approximately thirty per cent.

Certain of the poorer grades of coal heat so readily that some plants have provided storage space under water. Even the better grades will heat and burn if not properly stored. Thermometers located in test pipes will serve to indicate the existence of fire, but any attempt to extinguish it with water will generally prove useless unless the coal is removed from the pile. This is costly, both in the loss of the coal itself and in the labor involved in uncovering and removing the portion which is on fire. This feature makes the problem particularly serious when the coal must be stored for a year or more.

When coal is stacked wholly by means of a crane, the lumps roll down the sides of the pile to the ground and form the bottom layer. The spaces between the lumps permit the access of air so necessary for spon-

taneous ignition. It is a well-established fact that the absorption of oxygen by piled coal produces heating and subsequent fire. The problem, then, is to exclude the oxygen as far as possible. The very best results would be obtained with fine coal free from lumps, but even with coal of various sizes, if it is of fairly good grade, the packing process will practically eliminate the possibility of spontaneous ignition.

The Philadelphia Electric Company has stored 200,000 tons of a great variety of bituminous coals by this method during the past three years and have had no fires, even though the pile when full is approximately 100 feet wide and 30 feet high. The coal at this plant is spread by a locomotive crane in layers about two feet thick and leveled with a caterpillar tractor dragging a heavy roller. This is continued until the desired height is obtained. Finally, the pile is trimmed by having the crane remove the loose coal from along the bottom edges and place it on the top of the pile. The coal is packed so tightly that it sheds water. A series of observations indicates that there is no circulation of air through the pile and that the temperature of the interior is safe.

The Fourth of July Toll.

Killed, 111; injured, 1,030; mostly children—such is the casualty list resulting from the use of fireworks during this year's celebration of the Fourth of July, according to statistics compiled by the American Museum of Safety and the National Committee for the Prevention of Blindness, following an analysis of reports from 500 cities in 36 states. Of the injured 148 probably will lose the sight of one or both eyes, 79 have been disfigured through the loss of an arm, leg, or fingers or through other mutilation, 2 have lost their hearing, and one the power of speech.

In the reports of more than a thousand fireworks casualties there is evidence of only 62 arrests. Approximately 800 of the casualties occurred on July 4, more than 200 taking place before and after Independence Day, some as early as June 24 and as late as July 23. Only 30 of the casualties occurred in connection with public celebrations.

Of the 111 persons who lost their lives in the celebration of Independence Day, 37, mostly children, were burned to death when their clothing was ignited by so-called harmless sparklers, other fireworks, and bonfires; 25 deaths were caused by lockjaw following burns from blank cartridges, cap pistols, firecrackers, and gun shot wounds; 19 persons were literally blown to pieces by premature and accidental explosions; 8 persons were shot to death; 22 died as the result of accidents involving torpedoes,

sky-rockets, roman candles, and ordinary firecrackers; 6 of the latter included very young children who were poisoned by eating firecrackers.

The largest list of casualties was received from St. Louis where 73 persons were seriously injured and 60 suffered minor injuries; this is undoubtedly due to the fact that St. Louis was more thorough in reporting Fourth of July casualties than other cities. Unusually heavy casualty lists were received from a number of comparatively small cities in Pennsylvania; Pottsville, for instance, reported 21 casualties, Scranton 13, Lock Haven 12, Altoona 12; Detroit reported 27 casualties; Bayonne, N. J., 19; Hartford, Conn., 17; Chicago, 16; Elmira, N. Y., 11; New York City, 10; Waterbury, Conn., 9; Wheeling, W. Va., 8; Kansas City and Butte, Mont., 7 each: Hibbing, Minn., and Spokane, Wash., 6 each; Cleveland and Denver 5 each; Los Angeles and San Francisco 4 each; Dallas, Providence, and Philadelphia 3 each.

The total of 111 fatalities and of more than a thousand other casualties reported represents only a part of the actual sacrifice of human life and limb which takes place annually in the United States during the month of July; no reports were received from twelve states including many in the South where few restrictions are placed on the sale and use of fireworks. Were it possible to secure a complete record of Fourth of July casualties it would probably be found that several hundred persons were killed and several thousands injured in this year's celebration. If a record had been kept of the casualties resulting from the use of fireworks since 1776 it would undoubtedly be found that more persons have been killed and injured during celebrations commemorating our Independence Day than were killed and injured during the Revolutionary War.

The fact that in New York City, among a population of more than six million, there were only ten casualties and that in Chicago, among a population of more than three million, there were only sixteen casualties, is convincing evidence of the effectiveness of restrictive legislation, properly enforced. Most of the casualties reported occurred in the smaller cities where fireworks are still being sold to children of any age.

Courtesy of the Memphis, Tennessee, Fire Department and *Laboratories' Data*

The service wires on this building carried current to an adjoining building. A short circuit in these wires at the adjoining building resulted in the condition shown, there being no fuses between the overloaded wires and the main feeders.

Electrical Reinspection in New York City.

By J. C. Forsyth (Member N. F. P. A.).

Chief Electrical Inspector, New York Board of Fire Underwriters.

Over ninety per cent of the loss caused last year by fire from electrical causes in New York City, $350,375.84, was either directly chargeable to improper maintenance of electrical apparatus or to alterations and extensions made without the knowledge or approval of the underwriters' inspection department.

Other years showed similar conditions, and it was apparent that if a further reduction was to be made in losses from electrical fires it must come as the result of some effort to maintain existing electrical equipments in a safe manner—in other words, reinspection.

Careful inspection of new work has proven its usefulness—the losses from fires of electrical origin in New York in places where the equipments were in satisfactory condition at the time of inspection amounted last year to but $37,174, an insignificant amount in comparison with the billions invested here in improved property.

We are not yet engaged in reinspecting in a large way. So far we have been feeling our way along to see whether or not the work was really worth while. Last year our men completely reinspected 4,042 buildings and 13,974 equipments. Of these, 8,379 equipments or 60 per cent were defective. These defects to the number of 5,252 were corrected.

When the owner does not correct the fault our only recourse is to bulletin the building so that the fire insurance companies will know the condition of the risk. We have certain designations to show the relative degree of danger of the risk.

The insurance companies carrying a bulletined building then communicate with the owner and offer him the opportunity of correcting the fault or of paying a substantially higher premium. Generally speaking he pays.

Last year 1,170 buildings were bulletined and 624 bulletined buildings were corrected.

We have to be very careful on reinspection work. Because so many equipments complied with the National Electrical Code as of the time of installation and are still good judged by the standards of that time, we are not able to make any standard for reinspection. Our only guide, therefore, is the judgment of our best men that the work inspected either is defective

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or not. In other words, an equipment judged defective is plainly defective beyond a shadow of a doubt.

Our method of picking buildings for reinspection is simple. We take a map of the city, mark off the high valued sections and go over them first.

The high valued risks are usually in office building zones, loft and storehouse sections, large apartment houses, etc. Department stores and churches are also carefully inspected.

Classification of Electrical Fires in New York in 1924.

These fires may be classified as follows:

	Fires	Losses
Contacts defective	12	$26,560.00
Current entering building over metal conduit, etc., to interior ground connection	12	1,779.62
Fuse, operation igniting adjacent flammable material	7	.....
Fuse operation (neutral of 3 wire branch circuit)	1	.....
Flexible cord, short circuits and grounds	27	95,685.00
Grounding of conductors in conduit or in contact with other metal work	41	6,145.00
Grounds due to moisture	15	855.00
Heaters, warmers or pads, left in circuit	16	5,602.58
Lamps: Incandescent, ignition of flammable material	23	7,465.00
Motion picture film, ignition at machine in booths	6	550.00
Motion picture film (miniature type machine not in booth)	3	235.00
Motors, sparks from	25	7,091.88
Motor and generator windings	46	71,835.00
Pressing irons left in circuit (91 in 1922) (68 in 1923)	126	94,394.25
Radio receiving equipment, lightning	2	65.00
Radio receiving equipment, short circuit of leads from storage battery	8	2,180.00
Services: of illuminating company overhead	21	.....
Short circuits, accidental	37	19,751.48
Short circuits in elevator cables	7	875.00
Short circuits in sockets	7	560.00
Splices defective	52	3,935.00
Transformer insulation breakdowns, in vaults	13	.....
Volatile liquid or fumes	16	24,500.03
Automobile storage cell short circuit	2	525.00
Rheostats defective	2	60.00
110-volt D. C. current used for burglar alarm systems	2	50.00
Short circuit of switchboard bus bar	2	14,200.00
Short circuit of conductors in wood moulding by moisture	1	50.00
	532	$387,549.84

The fault we find most prevalent in existing equipments is without doubt the misuse of flexible cord. It is surprising to see some of the ways people use flexible cord and expect it to pass the inspector. It is carried around base boards, stretched across ceilings, sunk in door jambs and even hidden under carpets where everyone walking across it will damage it so that trouble is inevitable. This is by far the most common fault we find and the men have come to look for it first.

Next, I should say, comes over fusing, running a good second to the violation previously mentioned.

The safety valve of an electrical installation is the fuse. I have some data at hand that was collected a short time ago on fusing conditions which might be of interest. It covers residences, apartments, stores and factory lighting, and motors.

The figures are well worthy of study and doubtless show a condition that is common in other cities as well as New York.

Residences were found with 60 per cent having 10-ampere fuses, 30 per cent having 15-ampere, and 10 per cent having fuses of 20-ampere capacity. The mains were found to be normal.

Apartments were found to have 90 per cent of fuses of 10-ampere capacity, 5 per cent of 15-ampere and 5 per cent of 20-ampere capacity. The mains here were also found to be normal.

In stores, however, a different condition was found to exist, 10 per cent of fuses being 10-ampere, 10 per cent of 15-ampere, 10 per cent of 20-ampere, and 70 per cent of 30-ampere capacity. The mains were found to be only 10 per cent normal, 20 per cent were over fused and 70 per cent were bridged.

Factories were found to be not far different, 20 per cent of fuses being of 15-ampere, 20 per cent of 20-ampere, and 60 per cent being 30-ampere fuses. Here, too, the main conditions are interesting, 10 per cent only were normal, 40 per cent were over fused and 50 per cent were bridged.

Direct current motors showed that 30 per cent were normal and 70 per cent were over fused; while A. C. motors showed only 10 per cent were normal, 60 per cent being over fused and 30 per cent bridged.

In third place, I would put the deterioration of insulation on conductors. We always look for this and almost always find it. Wires are often placed where water or acids can drip on them and ruin them. This is especially true in elevator wells where the amateur has rigged up a lighting system and the wires drag in the pools of water that accumulate in these places. Wires are also found in places where they come in contact with moving objects and the insulation is soon scraped off. This is not uncommon and is found in lofts, storehouses, etc.

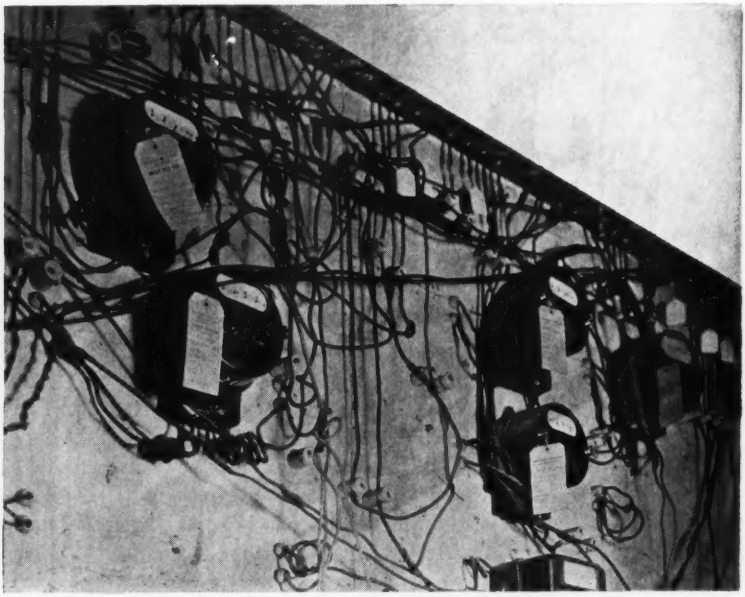
An analysis of the 532 electrical fires which caused a loss last year in New York of $387,549.84 is given in the accompanying table, 90 per cent of which has been stated was due to improper maintenance or unapproved alterations and extensions.

This obviously is due to the tampering with existing wiring by office boys and others who have no knowledge of electrical safety and the way to maintain it.

Janitors, housewives and even school boys seem to think that the only thing to be careful of in wiring is that two bare wires do not touch, and

when my men find poor work that is unsafe and want to have it rectified, a debate sometimes follows.

In the majority of cases I am glad to say that I find owners and contractors glad to live up to the letter of the law regarding electrical safety. It seldom happens that we have any serious difficulties and in every case we have found that a sensible discussion of the trouble with the persons responsible will generally end with the work being done to our satisfaction.



Courtesy *Laboratories' Data*

A study in crossed wires. Showing conditions found in an apartment building in Seattle. No fuses in sight and crossed wires ready to start trouble. This was replaced by a safe installation, with proper fuses and cabinet, at a total expense of approximately $180.

Small Town Water Distribution Systems.

By Clarence Goldsmith (Member N. F. P. A.).
Assistant Chief Engineer, National Board of Fire Underwriters.

In the design of the pipe distribution system of water works to supply a small town, the selection of the pipe sizes should be based upon the fire protection requirements. The rates at which water must be furnished to supply even moderately adequate fire protection far exceed those which are required for domestic consumption and the few manufacturing activities. Consideration should be given, therefore, to determining the probable fire demand.

Sections containing small dwellings of low heights occupying not more than one-third of the block front require two fire streams, or not less than 500 gallons per minute. It is true that a large proportion of fires occurring are extinguished by chemicals, small appliances, and perhaps a dash of water from a single hose line, but provision should be made to cope with a fire which has reached considerable magnitude by the time the fire company arrives. Where the buildings are sufficiently close to expose one another, i. e., with a separation of 50 feet or less, such as occurs at and near the business center, a further complication occurs, for additional streams are needed to protect the exposed building or buildings. It may be assumed, therefore, that two additional streams or four in all should be provided for even the smallest community at places where buildings are grouped.

For effective fire fighting in order to prevent the fire from spreading from building to building where the buildings are congested, the streams should be of sufficient size to penetrate the burning building and wet down those buildings which are exposed. This requires playpipes having nozzles of 1⅛ to 1¼ inches in diameter and fair pressures, for a nozzle pressure of from 30 to 40 pounds is required to give an effective horizontal or vertical reach of about 60 feet. It therefore appears reasonable that towns having populations of 2000 or less should have four or more fire streams of 250 to 300 gallons available, which makes a minimum requirement for fire protection of from 1000 to 1500 gallons a minute. More water is required for the protection of larger towns, and this subject has been thoroughly covered by previous papers.

A paper presented before the Fire Protection Division of the New York Convention of the American Water Works Association, reprinted by courtesy of the *Journal of the American Water Works Association.*

The next step in the design of a distribution system is to provide for the concentration of the streams. The friction loss in fire hose is one of the greatest limiting features in fire fighting, and, together with the number of streams required, determines the location and spacing of the hydrants, for unless a sufficient number of hydrants are provided, the loss in the long hose lines renders an otherwise satisfactory supply ineffective. In order that there may be no unnecessary loss between the mains and the nozzle, the hydrants should be of such size and design that the losses in them are kept at the minimum. The hydrants should have a sufficient number of outlets to permit the connecting of the required number of hose lines. With the assumption that four fire streams are the minimum required for any group of buildings, it is evident that at least two hydrants should be available. Hose lines should not exceed 400 or 500 feet in length, which requires that the hydrants be not more than 300 or 400 feet from the buildings to be protected. Where direct hydrant hose streams are used, these distances should be about 100 feet less than when fire engines are available to raise the pressure. As a general proposition, there should be one hydrant at each street intersection, and intermidiate hydrants should be set where the distance between street intersections exceeds 350 or 400 feet.

When the quantity of water required for fire fighting needs has been determined, a map should be prepared showing the streets; and buildings and groups of buildings to be protected should be indicated on the map. It then becomes a simple matter to place on the map the necessary hydrants to enable the number of streams required in the various parts of the town to be concentrated in a satisfactory manner. With this preliminary information available, the design of the distribution system can be approached in an intelligent manner.

Although it generally would not be economical in designing a distribution system for a small town to provide for the protection of additional values, which would probably develop in the next fifteen or twenty years, yet the design of a system should be made with this in view. It would not mean that the mains to be laid should be of sufficient capacity to care for these possible future demands, but the pipes now being laid should be so routed and of such capacity that while taking care of present requirements they would lend themselves to incorporation in a system which might be required twenty years hence.

The location of the source of the supply has a most important bearing on the design of the distribution system, for the maximum fire demands necessarily tax any economically designed distribution system to its utmost, and, therefore, all mains laid should be located with the idea of making them available as water carriers to the points where the greatest

fire demand will occur. This is usually in the center of a town, although frequently a group of manufacturing buildings or warehouses along the railroad in some other part of the town may require as much and sometimes more water than the mercantile center. It is desirable to have the mains serving the central section enter from at least two sides in order to utilize their greatest capacity and, at the same time, secure reliability in case of accident. It is seen, therefore, that the most ideal layout is to have a pumping station on one side of the city and elevated storage on the other side, provided the topography is such that a sufficient elevation is available for a reservoir. Standpipe storage is seldom of any value in an extended fire, but such storage is often economic from the operating standpoint, as it permits the shutting down of the pumps in small plants during the night and also can furnish the fire demand for the short period required to get additional boilers, pumps or other equipment into service in case of a large fire. It is always desirable to have the capacity of the elevated storage sufficient to equal or nearly equal the fire demand for a five-hour period.

When the location of the source of supply has been determined and it has been decided whether the fire supply could be best supplied from elevated storage, it is then necessary to determine whether dependence for fire fighting will be placed on the pressures carried in the mains or on fire engines. Effective fire streams require that pressures be maintained at the time of fire flow at about 60 pounds at the hydrant, although where buildings are low and scattered, this pressure may be reduced to 50 pounds. In order to maintain this pressure for direct hydrant hose streams, the amount of pressure which can be lost by friction in the distribution system is necessarily very small. Where fire engines are used they can secure an adequate supply of water if the pressure at the hydrant is reduced to about 20 pounds, and in some cases where the mains are of ample size and low pressures are carried, due to low elevation of reservoir, pressures lower than this are capable of furnishing a satisfactory supply, but it is advisable to have 20 pounds available to overcome the friction loss in the hydrant branch, hydrant, and suction hose. In direct pumping systems it is practicable to carry fire pressure up to 100 pounds. When it has been determined what pressure is to be carried, either by the elevation of the reservoir or the elevation of the supply works, and the pressure to be carried at the pumping station, it is an easy matter to calculate the total permissible drop in pressure in the mains, due to friction, in order to furnish either 60 pounds or 20 pounds at any point in the system.

In order that the discussion may be confined as closely as possible to distribution systems, it will be assumed that the pumping station is located fairly close to the center of the town or that the supply main is of suffi-

cient size to deliver ordinary consumption demands with only a few pounds drop in pressure. This is a reasonable assumption as the fire demands far exceed the consumption demand in smaller towns.

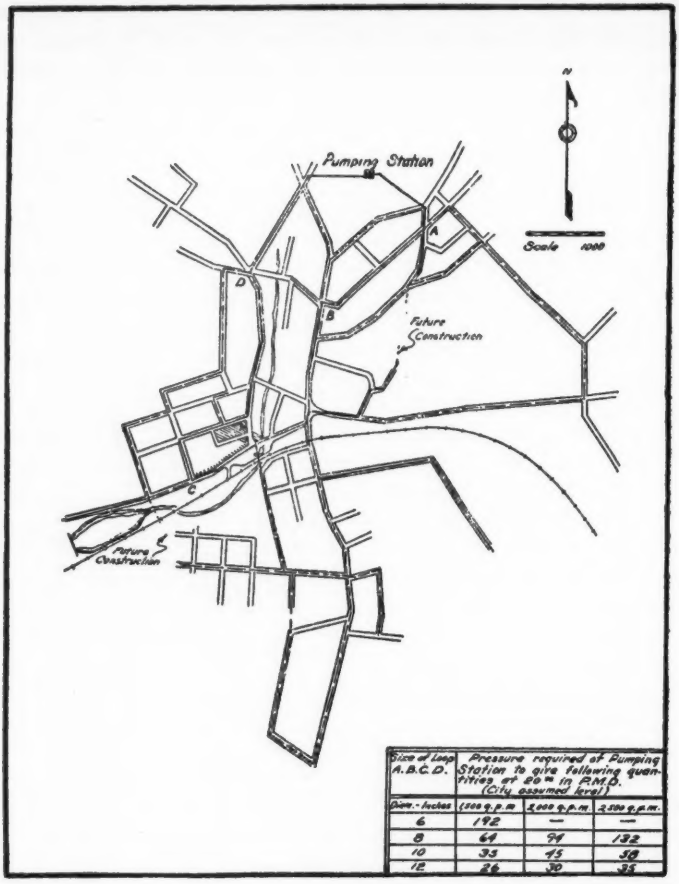
A study of the street map should now be made in order to select the most direct routes from the supply works to the point of greatest demand so that unnecessary friction losses will not be built up by following circuitous routes. At the same time consideration must be given to the protection of buildings between the pumping station and the center of the town. It is advisable to select certain streets through which additional mains may be laid in the future to meet the increased demands due to growth. After the locations of the through mains have been determined, the best method of connecting them and the best method of tying them together by mains of sufficient size to deliver the required capacity where it is needed should be considered. When this has been done, the next step is to provide mains to supply the other sections which it has been decided to serve. Mains extending into these sections should be looped, if possible, so that more adequate and reliable supply may be available from the hydrants than if they were supplied from dead ends, for friction losses are much less when equal quantities of water are being drawn from a looped line.

In making the preliminary design it will be found advisable to provide a fairly extensive system, and if estimates show that its cost will exceed the funds available, it will be possible to eliminate the immediate installation of mains in some of the streets by re-routing some of the lines and setting a second hydrant at some street intersections. When the growth of the city requires additional protection, in certain sections, the laying of mains in the streets originally left vacant will sufficiently reinforce the distribution system to meet the increased demands. In making this study, however, decreasing the sizes of mains for economic purposes should not be considered. It will probably be found necessary to furnish domestic consumption in some of the streets not served by the large mains which are originally installed, but this can be taken care of by laying service pipes of sufficient size to the premises of the consumer. One- and two-inch pipe will generally be found adequate for this service. By adopting this method it will be unnecessary to trench entirely through each street, and thus money can be saved. In the end this method is preferable to laying 4-inch mains, for they are not considered suitable for fire service. Friction loss in pipe of this size is 3 pounds per 100 feet for a flow of 250 gallons, and twelve pounds for 500 gallons. It is theoretically possible to use short lines of 4-inch pipe for supplying one intermediate hydrant, but the actual saving in cost in using this small size pipe over using 6-inch pipe is not sufficient to justify its use, particularly

as the capacities of modern fire engines range from 300 to 1000 gallons per minute, and average about 700 gallons. For the same reason it is undesirable to use 4-inch pipe for hydrant branches. Excellent fire protection in smaller places can be furnished by 6-inch pipe when looped or forming part of a gridiron system; however, when dead end lines exceed 800 feet in length, and it does not seem probable that they can be looped or connected for sometime, it is economical to use 8-inch pipe.

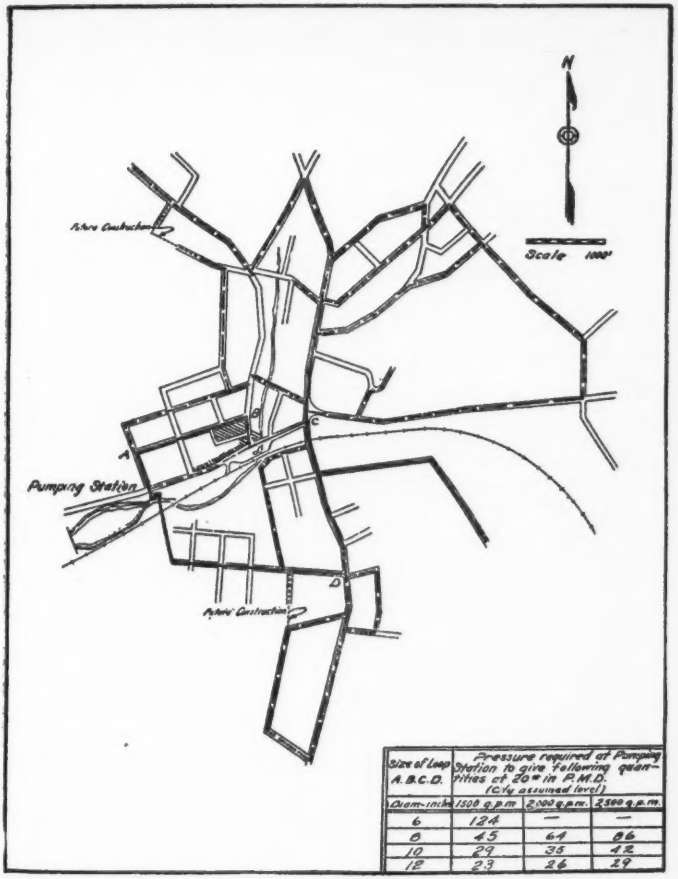
In laying out any distribution system the idea should not be lost sight of that it may be necessary to cut out any line at sometime in order to make repairs or connect into some extension. It is, therefore, essential in order to furnish reliable fire protection that two or more lines be laid in preference to a single line of equal carrying capacity. From pumping stations the mains should extend along two or more different routes and ultimately meet at or near the place of greatest demand. It is often desirable to lay mains cross-connecting the principal feeders or force mains from the pumping station in order to provide local fire protection and domestic consumption, but it should be remembered that these mains do not contribute in any appreciable degree to the carrying capacity of the distribution system to the point of maximum demand, as their function is confined to furnishing the local supply or to give greater concentration at some intermediate point along one of the supply mains, i. e., if there are two mains from the pumping station to the mercantile district, a cross-connecting main at a half-way point will not carry any flow of water during a demand in the mercantile district, unless the size of one of the principal mains is changed at some intermediate point, in which case the cross-connecting main will come into play, and by equalizing the flow, enable more water to be delivered into the district considered.

When a system has once been installed, it is of prime importance that it be operated with all the valves open. This point is not only pertinent in a small town system, but assumes equal, if not greater importance, in larger distribution systems. In some larger cities it has been the custom to extend large mains for considerable distances through the distribution system without making any connections, or if they be made, operating with the valves on them closed. These mains are termed "trunk" or "express" mains, and are operated to deliver into remote areas under the impression that this means a more satisfactory supply is assured. This is an erroneous assumption, for it is evident that if the distribution is so weak as to cause excessive losses under domestic consumption demand it will be entirely inadequate to furnish fire protection. When pressures in outlying sections are depleted to such a degree that the service is unsatisfactory, it should serve as a warning of the necessity of additional main carrying capacity, not only to deliver water into these out-



Size of Loop A.B.C.D.	Pressure required at Pumping Station to give following quantities at 20 lbs in P.M.D. (City assumed level)		
Diam. - Inches	1000 g.p.m.	2000 g.p.m.	2500 g.p.m.
6	192	—	—
8	64	94	132
10	33	45	58
12	24	30	35

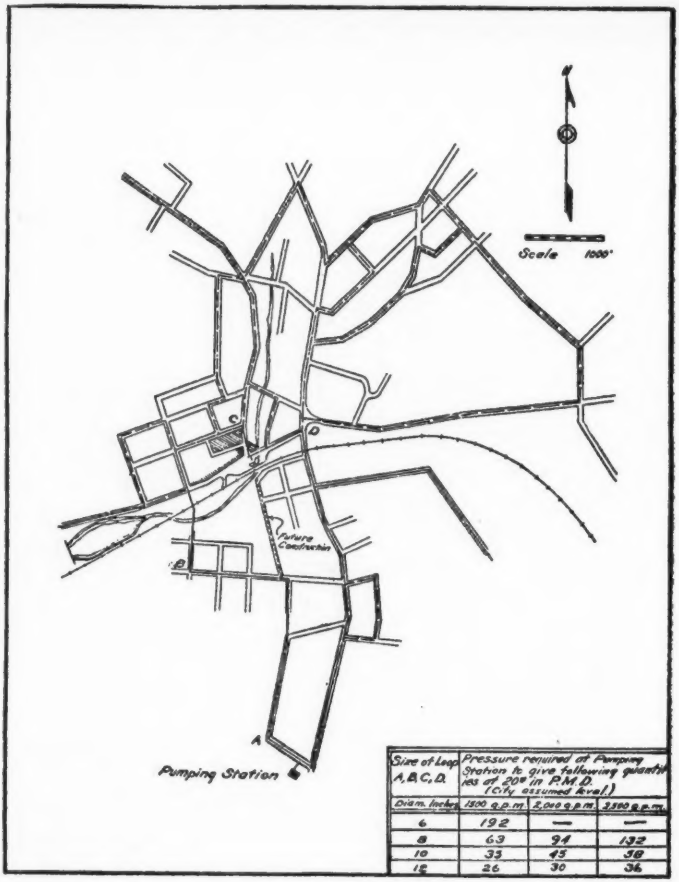
lying sections, but to increase the supply to the intermediate area. In a recent investigation the gates along a 16-inch line, which was originally connected to 6- and 8-inch minor distributors at street intersections, were found closed in order to make the large main serve as a trunk feeder into a district where pressures were depleted during periods of maximum consumption. Although the static pressure in the section served by this trunk line had been raised a few pounds, flow tests indicated that the fire protection available in the section had not been increased because at the time of fire draft dependence had to be placed on the 16-inch main and the carrying capacity of the intermediate mains of the distribution



Size of Loop A.B.C.D.	Pressure required at Pumping Station to give following quantities at 20# in P.M.D. (City assumed level)		
Diam.-inches	1500 g.p.m.	2000 g.p.m.	2500 g.p.m.
6	124	—	—
8	45	64	86
10	29	35	42
12	23	26	29

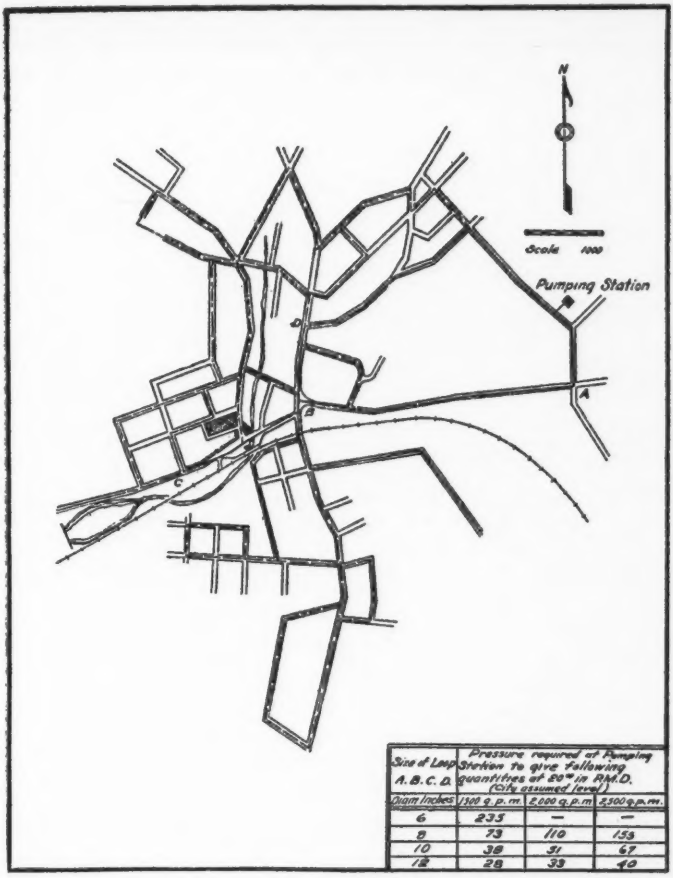
system could not contribute to carry the fire flow on account of the closed valves. In the sections through which the main had been cut off from the distribution system by closing the valves, the available quantities for fire protection had been reduced to less than one-fourth those previously available, and with four hydrants open none could deliver 500 gallons a minute.

In many systems it appears to have been the opinion of the engineers installing large mains leading from the pumping station that it was unnecessary to connect all of them to the intersecting mains of the distribution system. This may be true where these supply lines extend



Size of Loop A,B,C,D.	Pressure required at Pumping Station to give following quantities at 20# in P.M.D. (City assumed level.)		
Diam. Inches	1500 g.p.m.	2,000 g.p.m.	2500 g.p.m.
6	192	—	—
8	63	94	132
10	33	45	58
12	26	30	36

along the same or adjacent streets, but where they follow fairly well separated routes, it is obvious that these mains should be connected so as to feed the territory through which they pass. Frequently the argument is advanced that the cost of the specials and additional gate valves necessary to make these connections is not warranted, and the reliability of these important lines is menaced by the large number of connections. It is not necessary to connect each intersecting main with a large main, but all lines 8 inches and larger in diameter should be connected; also those 6-inch mains which are not cross-connected within several blocks of the large main. The best and most reliable method of connecting large



Size of Loop A.B.C.D.	Pressure required at Pumping Station to give following quantities at 20 lbs in R.M.D. (City assumed level)		
Diam Inches	1500 g.p.m.	2,000 g.p.m.	2,500 g.p.m.
6	235	—	—
8	73	110	153
10	38	51	67
12	28	33	40

mains with the minor distributors is by means of a run-around connection. These connections can be made between existing pipes by the use of tapping machines.

Four sketches have been prepared showing the possible design of distribution systems, with decidedly different street layouts, which will furnish adequate fire protection in towns having populations of from 1000 to 1500. The design and installations of water systems of this character are generally carried out by consulting engineers, and when they are completed, they are turned over to the town authorities for operation. Those to whom this responsibility has been entrusted should

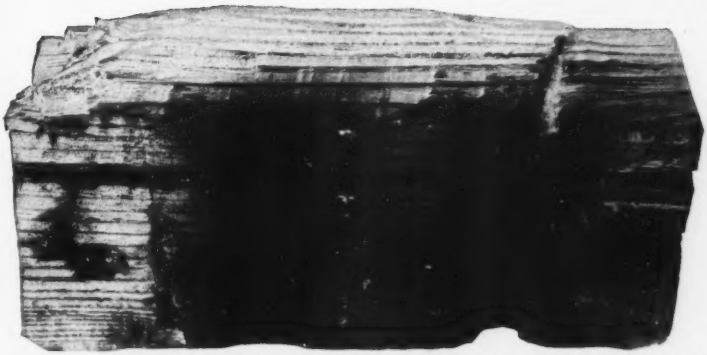
exercise the utmost care in so maintaining the system that it can operate at all times up to its designed capacity, and the officials of the fire department should always use the utmost discretion in determining the number of hose streams to be used, for if dependence is placed on direct hydrant hose streams and one or two streams in excess of the capacity of the system are used, the pressure at the hydrants may be sufficiently depleted so that all will be inefficient. If dependence is placed on pumpers, care should be taken not to endeavor to overtax any line so that the pumper nearest the fire will not be able to obtain a sufficient supply to develop the number of streams for which it is designed.

Following Instructions.

The popularity of the recently issued pamphlet of the Field Practice Committee, "The Watchman," indicates the general opinion that this class of individual needs comprehensive instructions. Of interest in this connection is the following case, reported by *The Spectator*, where a watchman followed instructions in a very exact fashion.

A fire occurred in a publishing establishment. Owing to the nature of the contents, consisting of a large supply of paper, the watchman had been carefully instructed in regard to the manner of shutting off the sprinklers. In the course of time it came to pass that the fire occurred, and our good watchman, having in mind the lesson which had been so often fixed upon him, promptly shut the sprinklers off and the loss by fire was considerable. He evidently had completely missed the fact that before shutting the sprinklers off he should have made sure that the fire was out.

He did not stop there, however, but he proceeded to display other rare signs of intelligence. His further instructions had been, when a fire occurred, to ring in an alarm. So, having shut the water off, and thus permitted the fire to continue to burn, he rushed out of the building to ring in an alarm. Between him and the nearest fire-box was a fire department station. Running right by this, he kept on until he reached the fire-box and rang in the alarm.



Photograph of a wooden support to which a steam coil was attached by pipe clips. The steam pipes, in contact with the wood for several winters, had charred it badly. (This photograph is reprinted from the Quarterly, Vol. 12, No. 1.)

Low Temperature Ignition of Wood.

That wood can ignite at comparatively low temperatures when they are of long duration, has long been a well established fact. In the January, 1911, QUARTERLY (Vol. 4, No. 3, p. 312) there appeared an interesting article on the Fire Dangers of Steam Pipes, by Mr. H. W. Forster of the Independence Bureau, which contained a record of numerous fires that were traceable to that cause. An article in the *Engineering News-Record* for May 28, 1925, of which the following is an extract, gave interesting substantiation of the existence of this fire cause, and reopened discussion of the subject:

The Portland Electric Power Company's steam station L, which is located near the center of the city of Portland, Oregon, on the bank of the Willamette River, was built in 1910 to house boilers, steam turbines and generators. The building is 130 by 160 feet in plan and the weight of the structure itself plus that of the equipment contained and the 300 ton chimney is distributed over the foundation by means of a concrete slab, 3 feet thick, which in turn rests on Douglas fir piles, spaced on 3 foot centers each way over the entire area.

The tops of these piles deteriorated to such an extent that late in 1923 it was decided that some new support for the slab was necessary if serious settlement was to be avoided. A scheme was then devised for cutting the piles off 14 feet below the slab and substituting precast concrete beams and columns as slab supports, without interfering with the operations of the plant.

Charred Piles—Under the boiler room the piles were in general decayed about the same as they were under the engine room, being soft for a few inches at the top and sound below. However, under the ash pits the tops of the piles were charred away, leaving the concrete mat under the ash pits almost unsupported. This charring occurred despite the fact that in addition to the 3 foot thickness of the concrete mat there was about 2 feet of earth fill in the bottom of the ash pit. The normal ash pit temperature is about 700 degrees F.

Courtesy *Engineering News-Record*

Charred pile tops from under ash pit. Long continued temperatures of 700 degrees F. in ash pit penetrated 2 feet of earth and 3 feet of concrete, destroying the tops of supporting piles.

The above article brought the following comments from a reader of the *Engineering News-Record* to its editor.

Decomposition of Wood Exposed to Heat.

Sir—Referring to the account of foundation piles which were charred by long exposure to a comparatively low temperature, it is quite well known in some circles (though it needs wider advertising) that some woods slowly decompose or char at temperatures little above the boiling point of water. Decomposition is accelerated on a rising temperature, becoming very rapid below 500 degrees F. Attempts to insulate even medium-pressure steam pipes with wood have failed for this reason.

Wood may, however, withstand considerably higher temperatures if exposed to a moist atmosphere.

In the case described the piles were in sand and gravel soil which permitted water to drain away. They were probably bone dry. Their temperature could not have been very much over 225 degrees F. or they would not have lasted as long as they did. On the other hand, in a moist fine capillary soil capable of drawing up a continuous supply of moisture from below, they would probably not have charred at all.

Probably about 200 degrees F. is the highest temperature to which it is safe to expose dry, soft or resinous woods for long periods. Hardwoods probably stand up to heat a little better, though I have no data on these. Moist wood will not char at any temperature so long as it is under a pressure equal to or greater than the vapor pressure of water at the particular temperature. In fact, wood may be melted without decomposing or charring by heating it to something over 1,000 degrees F. while under very high pressure in an inert gas.

Downers Grove, Ill. LEO G. HALL,
June 6, 1925. Structural Engineer.

A few months before this time, Member Fitzhugh Taylor, protection engineer of Underwriters' Laboratories, received the following report of a fire in Cincinnati from Member James S. Mahan of the Western Actuarial Bureau with the request that he comment on it:

Ohio Inspection Bureau, Cincinnati Department—Fire Record.

The Cincinnati Terminal Warehouse Fire.

Date of fire. March 7, 1925, about 10:30 A. M.

The principal point of interest in this fire is its origin. The property is a sprinklered seven story fire-resistive warehouse with an adjoining two story unsprinklered fire-resistive power house. In the power house is a small boiler on the second floor with an ash pit underneath it on the first floor. The first floor of the warehouse is of reinforced concrete raised a couple of feet, leaving such a low blind space underneath that the wooden forms on which the floor was poured were not removed.

Heat from the ashes in the ash pit which is against the 12 inch brick wall between the power house and the warehouse set fire to the wooden forms under the warehouse. There are no openings or holes visible in the division wall so it seems simply a case of transmission of heat through a 12 inch brick wall. The ash pit is closed so that there was nothing to cool the ashes. Lack of air circulation in the blind space under the floor was also a factor not only in the ignition of the woodwork but also in its failure to spread to any extent. Cork block insulation on the wall in a cold storage room in the warehouse was also ignited either by direct heat through the wall or from fire beneath working up through interstices between floor and wall. The total area affected was less than a hundred square feet of forms and about the same of cork insulating block.

Mr. Taylor made comments substantially as follows after a study of the report:

Assume that glowing coals dropping into the ash pit are at temperatures around 1000° F. If there were no ventilating or other cooling influences in the ash pit to

carry away the heat produced by hot coals and ashes, it is conceivable that the accumulated material in the pit might quite commonly show temperatures of at least 500 or 600° F. after the pit had been gradually heated up through a somewhat prolonged period of service. If this hot material remained in more or less continuous contact with the 12 inch brick division wall which separated the ash pit from the concealed space under the adjoining warehouse floor, it might be expected to bring the ash pit face of the brick wall to about the same temperature. During this process the brick wall would slowly conduct heat away from the ash pit, thereby heating the brick wall throughout its thickness; and temperature explorations at various points in the brick wall would probably show a decreasing gradient of temperature, the highest values being at the face in contact with the hot ashes and the lowest at the opposite face in the concealed space under the warehouse.

Rise of temperature on the far side of the brick wall would be limited by two factors,—

(*a*) The amount of heat conducted upwards and perhaps sidewise and downwards in the brick wall, and thus dissipated or distributed throughout the structure and into the foundation and earth. Little of this heat would reach the concealed space and it would, therefore, have practically no opportunity to contribute to any great extent to a rise of temperature on the far side of the brick division wall.

(*b*) The heat radiated into the concealed space and conducted away therefrom by air currents, if any, and by absorption into the earth and into the walls and ceilings of the concealed space.

The first of these factors may have been relatively small when compared with the quantities of heat carried into the ash pit by the ashes; and we judge from the report that the second factor also was of little moment.

It is conceivable, if very little heat could escape from the concealed space under the warehouse, that, after a considerable period of service, temperatures might have been attained therein sufficiently high to ignite the woodwork. There can be little doubt that under the conditions described the concealed space would *receive* heat from the ash pit in sufficient quantities to menace the woodwork in contact with, or very close to the wall, after the woodwork had become bone-dry and perhaps over-sensitive to ignition; it is perhaps rather remarkable that the concealed space as a whole could *retain* this heat effectively enough to cause ignition of the forms.

There are authentic records of instances in which woodwork has been ignited by close proximity to steam pipes which could not heat the wood to temperatures commonly considered as necessary for ignition. Occurrences of this kind indicate that wood which has been baked for long periods may ignite at relatively moderate temperatures. Probably the conditions beneath the warehouse floor in the case under discussion were favorable to such developments.

When the *News-Record* article appeared, Mr. Taylor called it to the attention of Professor Ira H. Woolson, then chairman of the N. F. P. A. Committee on Building Construction, who wrote as follows:

I do not remember to have ever noted similar trouble with a large heating plant due to the cause described. The New York Board of Fire Underwriters, however, reports considerable trouble during the last year or so with fires occurring in the decks of river piers underneath small heating boilers. These boilers are usually placed upon 8 to 14 inches of concrete, and sometimes sheet metal beneath the concrete. I do not know, of course, what the ordinary temperatures of these

small ash pits are, but presumably they would run moderately high considerable of the time.

Although reporting some half dozen fires of that kind, they are uncertain as to the real cause, whether it was heat conducted through the brick or concrete foundation or whether it was due to cracks which had occurred in the same. Usually after a fire the evidence is pretty well destroyed.

At his request I went with Mr. William B. White, of the New York Board of Fire Underwriters, to inspect one of these boilers then in operation upon a pier belonging to the New York Central Railroad. The ash box was about 5 by 8 feet. We found it quite clear of ashes and a good live fire reflecting its heat on to the foundation. A careful inspection indicated several cracks extending from the interior of the fire box under the foundation of the boiler and outside to the limit of the foundation which extended about 15 inches in width around the boiler. We could not get under the pier to examine the condition of the timber beneath the boiler, but could see nothing out of the way by looking from the sides under rather restricted conditions.

The cracks in the fire box were found to be thoroughly filled with fine ashes and could only be discovered by carefully brushing the surface with a broom and scraping the ashes out with a poker. As ashes are a very good non-conductor of heat, I would hardly think that the heat would travel through the crack any more freely than it would through the concrete, and yet it might for I have no direct evidence to sustain this thought.

They report no trouble with similar installations on land, and we are at a loss to know why. The supposition is that there are draft conditions underneath the pier which stimulate spontaneous ignition after the woodwork has become charred.

Later Professor Woolson called attention to a talk which he had given before the Eastern Pennsylvania Chapter of the American Society of Heating and Ventilating Engineers at the Engineers' Club of Philadelphia in 1921. This address contained the following discussion of the spontaneous ignition of wood due to the generation of pyrophoric carbon from long continued exposure to moderately low temperatures:

Another fire hazard is the danger of ignition of woodwork in contact with steam pipes, even though part of a low pressure heating system. Here again it is a case of slow—very slow—carbonization of the wood and later spontaneous ignition under exceptionally favorable conditions. Many instances of fires from such causes are on record.

My good friend, Mr. Forster, Vice-President of the Independence Bureau of your city, is the author of an excellent discussion of the theory of this cause of fire and cites many cases where fires from this cause have occurred and the circumstances surrounding them. The article was published in the NATIONAL FIRE PROTECTION ASSOCIATION QUARTERLY of January, 1911 (Vol. 4, No. 3, p. 312). I have myself seen two cases of well charred wood due to low pressure steam pipes.

The matter has been studied by numerous experts and the opinion as to what happens is briefly this: slow carbonization of wood occurs. It may take several years to accomplish this, but it does occur. It is known that carbon will absorb many times its volume of oxygen and in this condition is prone to spontaneous ignition, particularly if it should happen to get wet from any cause and later dry out, as might occur when fire in the furnace goes out and the pipes get cold at a

time when the surrounding atmosphere is damp enough to cause condensation on the pipes. Rapid re-absorption of oxygen by such dried out carbon is liable to produce heat, which is extremely favorable to spontaneous ignition.

Attempts have been made to produce such fires artificially, but these have usually failed because the time factor was not long enough to create the proper conditions. The latest attempt of this kind that has come to my attention is an investigation made at the Case School of Applied Science in 1910. The investigators were unable to obtain spontaneous ignition of wood in contact with the steam pipes, but were able to ignite charcoal, both moist and dry, in contact with such pipes.

They also described at some length the formation of pyrophoric carbon, a substance which some European investigators discovered was frequently produced during the formation of charcoal and at certain stages in the process this pyrophoric carbon is subject to considerable risk of spontaneous ignition. I quote from the foreign investigation report as follows:

"Pyrophoric carbon is also formed in other ways, as in manufacturing operations. Frequent opportunities arise for its formation and the occurrence of spontaneous ignition: a lamp hanging too near a beam, a steam pipe or hot air pipe laid too close to woodwork; dust settling down in thick layers on heated pipes; defective insulating material around a steam pipe, stove fireplace, etc., which are thereby enabled to radiate heat continually against wooden articles. All these possibilities may occur in any factory, and, under favorable conditions, often lead to very perplexing outbreaks of fire."

I also quote the following from the conclusions of the Case School investigation:

"The fact that we were unable to obtain any fires with the various substances in contact with steam pipes, except in the case of charcoal, both moist and dry, shows that not enough time was allowed for the formation of pyrophoric carbon; for, as previously stated, its principal formation requires the prolonged action of heat. The length of time necessarily varies, according to the condition of the woods, the steam pressure, and the exposure, that is, whether intermittent or continuous. All the samples of wood used in our experiments were new, a condition which, undoubtedly, would necessitate an exposure of long duration to the heat, certainly for a longer time than in our experiment.

"In reviewing the list of fires claimed to have been caused by steam pipes, it is a noticeable fact that in a majority of cases, the substances were exposed to the influence of heat for a long time. The fact that the ignition point temperatures, as shown by the flammability tests, were above those ordinarily found in steam lines, only indicates that the time allowed in the different tests was not long enough for the formation of either pyrophoric carbon or charcoal.

"After charcoal has been formed it has been shown by our tests that it can take fire. After the heat is removed on a damp day, charcoal also absorbs a large quantity of moisture, a condition which has already been stated is dangerous when steam is again turned on. Although it may not cause a fire, it is evident that its condition is extremely hazardous and liable to an outbreak of fire at any time.

"The conclusion drawn by the writers is that steam pipes are the cause of fires, due to either of the two causes, viz., the formation of pyrophoric carbon, or the reduction of organic matter to charcoal."

Not long ago, in discussing this subject with a heating engineer of my state, he boldly stated that he did not believe that low pressure steam pipes would ever cause a fire and said that so positive was he in this belief he had deliberately placed

the steam heating pipes in his own cellar in contact with wooden joists and partition to prove his claims. He certainly has the courage of his convictions, but I esteem it very bad judgment.

Further observations of interest are contributed by Mr. B. L. Whorf (member N. F. P. A.) of the Hartford Insurance Company, who writes as follows:

The most extensive case of charring from this action that I ever saw was in a large plant in western New York. The steam coils of a combined heating and ventilating system rested on the bottom of a steel casing which in turn rested on a platform consisting of ½ inch boards on planks over 1 inch thick. To my surprise the *under* side of the plank platform was browned and could be crumbled to pieces with the fingers. Without difficulty a hole was dug with the fingers through the platform, which was found to be charred all the way through, a condition which had been in the making for evidently some years. In the office with which I am connected we have a charred stick which was removed from contact with steam coils in a high school in central New York State, where the maximum steam pressure was ten pounds. Following are a few fires caused by this hazard, collected from various authentic sources.

PROVIDENCE, R. I., DECEMBER 10, 1907. Fire was discovered around steam pipes in the hollow space between the floors and ran up hollow partitions some distance before it was extinguished.

HOLYOKE, MASS., DECEMBER 16, 1914. Wood refuse came in contact with steam pipes and caused a $1,000 fire.

BUFFALO, N. Y., MARCH 20, 1917. A dye intermediate was being dried in wooden trays resting directly on steam pipes at 110 pounds pressure. Fire broke out but was extinguished. The substance in the trays, alpha-naphthylamine, would have had no bearing on the start of this fire.

LOCKPORT, N. Y., JANUARY 19, 1919. Super-heated steam pipes running through a wood monitor caused a $100 fire.

BOSTON, MASS., SEPTEMBER 28, 1919, Oily sawdust against steam pipes ignited and was put out by one sprinkler. The presence of oil greatly increases the hazard.

BROCKTON, MASS., 1921 or 1922. Fire originated at a point in the partition where a hot steam pipe was in contact with wood which at this point was deeply charred. A fire started in this charring and spread upward.

MIDDLETOWN, CONN., SEPTEMBER, 1923. The fire marshal of a large property found a room full of smoke and upon investigating caught a low pressure steam pipe in the act of starting a fire which was smoldering and was just beginning to blaze where the steam pipe was in contact with a caked mass of dirt, lint, and like material which had been swept back of the pipes.

The hazard of steam pipes is probably greatest in hollow-sheathed joisted buildings where the conditions around the steam pipes where they penetrate the floors cannot be seen. Fires must sometimes originate from this cause and, obtaining headway in the hollow space of the floors and partitions, destroy the building and the evidence of their origin. It would be a good thing if the man who is building a house or other property would take it upon himself to look over the steam or hot water pipes when they are put in to make sure that they have a 1-inch clearance from all woodwork and that sweepings or rubbish are not left against them inside the hollow space. The 1-inch holes through the floors for the radiator pipes should be closed by metal collars so that sweepings cannot enter through them.

Following are abridged descriptions of several typical fires taken from the fire records where wood has been ignited by sustained though comparatively low temperatures. For other fires see the QUARTERLY article by Member Forster above referred to, Vol. 4, No. 3, p. 312; also "Another Steam Pipe Fire," Vol. 14, No. 3, p. 290. Some phases of ignition of sawdust at low temperatures are described by Member C. E. Worthington in Vol. 14, No. 1, p. 38.

S-36247. JUNE 8, 1922, BUFFALO, N. Y. WOODWORKER. Fire originated in or near a wooden ventilator from a gluing and drying room. Fire was confined to a brick, joisted-roofed dry kiln in the third floor and was due to steam pipes, which were not covered, coming in contact with the woodwork.

S-33511. DECEMBER 18, 1922, BOSTON, MASS. MERCANTILE ESTABLISHMENT. Fire originated in a ladies' dressing room between floor timbers near steam pipes. The sprinkler over the fire failed to operate, but the fire was held in check by a sprinkler 12 feet away that did operate.

S-35660. PAWTUCKET, R. I., DECEMBER 18, 1922. COTTON MILL. The watchman discovered smoke in the dry room of the dye house and upon investigation found a fire in the corner of the room in a concealed space between the sheathing and the floor. A wooden flue which was open to the concealed space provided a good chimney, and this flue was on fire shortly. The only plausible cause of the fire is contact between a steam pipe and the woodwork. There were no sprinklers in the first four bays of the concealed space at the end where the fire started, and the fire was not easy to handle with hose streams on account of its somewhat inaccessible location, although four hose streams were brought into play. The operation of seven sprinklers prevented the spread of the fire from the flue to the main room. Loss was about $2,000.

S-33924. DECEMBER 19, 1922, WORCESTER, MASS. MACHINE SHOP. Fire occurred in the office in back of a desk, near a radiator at a point where a steam pipe passes through the wood sheathed wall.

S-38833. BABBITT STATION, N. Y., AUGUST 30, 1924. SOAP FACTORY. Steam coils were located in the bottom of a tank used to heat palm oil. The palm oil tank had a frame top which extended to the ceiling, the steam pipes passing through the wood in such a manner that there was no clearance from the woodwork. Fire started from the charring of the wood by the steam pipes. Two sprinklers operated and the employees used two hose streams on the fire, extinguishing it in a short time. Damage to the building was small, the largest loss being from the palm oil which was washed away.

S-39398. WOONSOCKET, R. I., JANUARY 28, 1925. PAPER MILL. Fire started from an overheated steam pipe which went from the boiler room through the floor of the main building. The overheating of the pipe was caused by low water in the boiler. A watchman used chemical extinguishers, which together with water from one sprinkler extinguished the fire. The loss was $150.

S-38049. PROVIDENCE, R. I., MAY 19, 1924. METAL WORKER. Fire started in the roof of a boiler house directly over the smoke flue from

the boilers. At this point there is a clearance of only 3 or 4 inches above the flue, and although the roof joists were insulated by fire clay and a strip of corrugated asbestos, the woodwork became charred and ignited by the heat. In fact, a similar fire previously occurred here. The fire was extinguished in a few minutes with pails of water and chemical extinguishers, causing a loss of $125.

S-40344. WATERBURY, CONN., JULY 14, 1925. BRASS WORKS. Around silvering tables in the mirror department the floor had been waterproofed by laying studs on the plank floor, covering them with boards, applying tar paper and finishing with a layer of asphalt. A 1 inch steam pipe carrying live steam at about 75 pounds pressure passing up through these two floors in direct contact with the wood and asphalt had gradually dried and distilled the wood until it was reduced to charcoal and finally ignited. The watchman on his rounds discovered the fire and extinguished it with a hose line from the standpipe before any sprinklers opened. The loss was small.

S-40369. CANAJOHARIE, N. Y., JULY 16, 1925. PACKING HOUSE. Heat from the fire box of a boiler passed through a 2 foot brick wall and then through an 8 inch dead air space, finally igniting the cork insulation of an abutting cooler. The cause of the smoke in the cooler was investigated, and when a hole was cut in the wall the cork burst into flames. The fire was quickly extinguished with chemical extinguishers. The loss was about $150.

Fire Hazard of Refrigerants.

Ethane, Propane, Butane, Ammonia.

By A. H. Nuckolls.
(Member N. F. P. A.)

The fire hazard of refrigeration systems is of great importance. In many cases refrigeration plants are located in congested districts, in the basements of large hotels, on board naval and passenger vessels, and in connection with cold storage warehouses. Ammonia has been used extensively in this country as a refrigerant for many years, and its hazard to life and property has been studied. Recently the use of propane as a refrigerant has been developed commercially, and the question of its hazard has become of great importance to manufacturers, underwriters, fire protection engineers and municipal authorities concerned with safeguarding life and property. This report contains a general summary of results of an investigation begun in January, 1923, to determine the fire hazard of propane gas. Supplementary reports presenting more critical discussion of the data will be published at a later date.

General Character.

Propane (methyl-ethyl), C_3H_8, is a gas of the methane series of hydrocarbons, known as the paraffins, which are regarded chemically as saturated hydrocarbons. It occurs in petroleum and natural gas.

In its general chemical and physical properties propane is in a class with methane, ethane and butane. It is slightly heavier than air, has no odor and is colorless. It is a liquid at ordinary temperatures when under pressure above 145 lb. per sq. in. (130 lb. per sq. in. at 20° C.). It is flammable when mixed with air in certain proportions, and under certain conditions may cause explosions similar to those produced by gasoline The heat ignition temperature is relatively high.

The gas is shipped compressed to about 150 lb. per sq. in. in steel cylinders similar to those used for oxygen.

It is used as a fuel in welding, and as a refrigerant in systems similar to those in which ammonia is employed, and which are known as the compression type of mechanical refrigeration systems.

This article is abstracted from a comprehensive report, published by Underwriters Laboratories, giving the results of an investigation conducted for the Carbide and Carbon Chemicals Corporation by Mr. Nuckolls, chemical engineer. Copies of the complete report, designated as Miscellaneous Hazard Report No. 1130, may be obtained at $1.00 each upon application to Underwriters' Laboratories, 207 E. Ohio Street, Chicago, Ill.

Plan of Investigation.

The primary object of the investigation was to determine the relative fire hazard of propane as a refrigerant.

There being no established method or accepted criterion for the classification of the hazards of gases, particularly in respect to explosion properties, it was necessary not only to conduct tests of the hazardous properties of propane but to investigate the relationship of these properties to the actual fire hazard.

The only practical procedure meeting these requirements, and which appeared to be fundamentally sound, was to conduct comparative tests with a number of gases, including: propane, ethane, butane, ammonia, gasoline, casing-head gasoline and illuminating gas. Gasoline vapor was included as the main basis of comparison because its fire hazard has been established and considerable study made of the relation of its actual hazards to corresponding properties as determined by tests. Ammonia has been used extensively as a refrigerant. Illuminating gas, which has been used quite generally, was included for comparison.

Methods of Test.

The tests referred to include analytical and identification tests, tests of ignition temperature, tests of explosion pressure together with the time of its development (the initial temperature and pressure being varied) and flame propagation.

Analytical and identification tests were made by fractional distillation at low temperatures supplemented by combustion methods.

The ignition temperature tests were made in a vessel heated at constant temperatures so as to obtain the lowest temperature at which there is danger of ignition.

The ethane, propane, butane, and ammonia gas-air mixtures for explosion tests were made up in cylinders under pressure. The gasoline vapor-air mixtures were prepared by means of a specially designed carburetor. The casing-head gasoline and illuminating gas-air mixtures were made up in a gas holder. These mixtures were analyzed before explosion tests.

The explosion pressure tests were made in a steel bomb, the pressure and time of its development being measured by indicators and also by especially designed apparatus.

The flame propagation tests were made in a steel cylinder 10 ft. in length, open at one end. The flame front was photographed by a special camera consisting of a system of lenses and mirrors for forming the flame and spark images on a film carried by a revolving drum. The time intervals between images representing the flame speed were determined by a tuning-fork time recording system connected with the camera.

Abridged Table of Properties.

	"Apparent" Ignition Temperature ° F.	Explosive Range Percent by Volume	Explosion Pressure in Bomb lbs. per sq. in.	Time of Development of Pressure Seconds
Methane, CH_4	998.6	5.6 – 13.5	——	——
Ethane, C_2H_6	950	3.3 – 10.6	105	0.018
Propane, C_3H_8	870.8	2.3 – 7.3	105	0.020
Butane, C_4H_{10}	806	1.6 – 6.5	105	0.027
Gasoline, C_5H_{12} to C_9H_{20}.	536	1.4 – 6.0	100	0.026
Illuminating Gas	1094	7 – 21	95	0.0172
Ammonia, NH_3	——	16 – 25.5	50	0.175

Results of Tests.

SAMPLES USED IN THE INVESTIGATION—Samples of ethane, propane, butane, and air used in the investigation were found by analytical and identification tests to be practically pure. The samples of gasoline, casing-head gasoline, ammonia, and illuminating gas were shown by the tests to be representative of their class.

SAMPLES OF AMMONIA—Samples of ammonia gas obtained from a number of mechanical refrigeration systems of the compression type, operating under normal conditions, were found to be practically free from hydrogen and oil.[1]

IGNITION TEMPERATURE—The "apparent"[2] ignition temperature of propane was found to be comparatively high, being in a class with that of ethane, butane and illuminating gas, but higher than that of gasoline. (See abridged Table of Properties.) The results of tests for the ignition temperature of ammonia were negative, and additional data on this feature are needed.

EXPLOSION PRESSURE—The static pressure developed by explosions of propane, butane, and ethane and their rates of development of pressure were found to be similar to that of gasoline-vapor, casing-head gasoline, and illuminating gas. Both the pressure produced and the rate of development of pressure in ammonia explosions were found to be much less than that of propane. (See Table.)

The explosion-pressure range and the low limit of the range of propane, butane, and ethane were found to be practically similar to that of gasoline-vapor, but less than that of illuminating gas. (See Table.) The low limit of the explosive range of ammonia was found to be relatively high (16 to 18 per cent).

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[1]NOTE: Hydrogen gas has been found to occur in ammonia refrigeration systems of the absorption type.

[2]NOTE: As used herein "apparent ignition temperature" refers to the lowest temperature likely to cause ignition.

FLAME PROPAGATION—The rate of flame propagation in mixtures of propane and air, partially confined, were found to be practically similar to that of gasoline-vapor in air, the highest rate of propane under the conditions employed being slightly greater than that of gasoline. The results of tests for rate of flame propagation in ammonia-air mixtures under the experimental conditions employed were negative.

Conclusions.

GENERAL FIRE HAZARD—The general fire hazard of propane, ethane, and butane is in a class with that of gasoline-vapor, casing-head gasoline, and illuminating gas, but greater than that of ammonia.

Propane, ethane, butane, and gasoline are considered to be less hazardous than ammonia and illuminating gas in respect to irritation and toxical properties.

FIRE HAZARD AS REFRIGERANTS—Comparing the fire hazard of propane, ethane, and butane as refrigerants with that of ammonia,[1] it appears that when confined in the refrigerating unit the hazard of propane and butane is practically similar to that of ammonia, and when discharged into the surrounding air the hazard is similar to that of gasoline-vapor and casing-head gasoline under like conditions, being greater than that of ammonia; but this increase of hazard in actual practice can be fully determined only by field experience, and will depend mainly on the successful design, construction and maintenance of systems capable of continuous operation without leakage, and safeguarded against the emergency hazard of mechanical systems operating under pressure.

Owing to the increased mechanical difficulties of construction and maintenance of units to withstand the higher pressure (about 680 lb.) required in refrigerating systems using ethane, it is probable that its hazard as a refrigerant will be materially greater than that of propane and butane, the working pressures of which are about 145 and 25 lb. respectively.

Protection of Industrial Systems.

Refrigeration systems using propane should be designed and constructed (1) to withstand without leakage the pressures to which they are liable to be subjected with a suitable factor of safety; (2) to be of the indirect expansion type[2] and to be provided with adequate safeguards to insure, (3) operating safety, and (4) emergency safety.

OPERATING SAFETY—(a) Design, and construction of systems to prevent leakage, and liquid refrigerant reaching compressor.

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[1]NOTE: In the present type of refrigeration systems (compression) quite generally used for ammonia, the expulsion of lubricating oil, together with ammonia, is apt to occur in case of rupture of the system, adding to the fire hazard.

[2]Means of inclosing the refrigerating units may be practical.

(b) A pressure limiting device to automatically stop the compressor in case the system is subjected to a pressure much in excess of the normal working gauge pressure.

(c) Odorize the refrigerant.

EMERGENCY SAFETY—Pressure relief device should be provided to automatically relieve the pressure by discharge of the gas to a vent[1] in case any part of the system is subjected to a pressure in excess of the limit of safety applying. One of these devices to operate automatically by rise in temperature and the other by pressure.

It may be assumed for all practical purposes that there is little if any danger of fire where 400 cu. ft. of room space is provided per pound of propane[2] or where constant ventilation provides 400 cu. ft. of free air per minute to each pound of refrigerant which may be discharged per minute. The room in which the system is installed should not contain any source of ignition.

EMERGENCY DISCHARGE VENT—The vent or vents (referred to under emergency safety) should discharge to outside air at a safe distance from flammable material or be provided with means to prevent discharge of gas at a rate and in quantities dangerous to surrounding property.

Mexico City Film Fire Panic.

By Clarence Heller.
(Member N. F. P. A.)

Little do those who treat fire so lightly think or realize how, under some conditions, the mere mention of the word "Fire" will throw a calm and carefree gathering into a frenzy of unreasoning fear. The ease and suddenness with which such a condition is produced and the grave consequences which follow is illustrated by a fire and panic which occurred in a moving picture theatre in Mexico City last year. An account of this disaster, which caused the death of 22 people, mostly children, and the injury of many more, has recently been obtained and is worth studying. The facts appear to be the following:

About 300 people were present at a small motion picture theatre in the town of Tacubaya, a suburb of the City of Mexico, a considerable portion occupying the gallery. A short circuit ignited the film in the projection room and, as the projection machinery and the lights were on

[1]Except in case of small household systems when safe room space or equivalent ventilation is provided.

[2]This statement applies within practical limits to all combustible refrigerants in use at this time.

the same circuit, this plunged the theatre in darkness. Someone, seeing the flash in the booth, raised a cry of "Fire!" which precipitated a panic in the gallery and started a stampede for the exits. One of them, an "emergency" exit, was found locked. In addition, the door from the base of the gallery stairs opened inward and could not be used on account of the weight of people against it. Consequently 22 persons were trampled or crushed to death in the fight to reach the outside. So intense was the struggle that the walls of the passage to the exit were cracked by the pressure of bodies against them.

The insulation on one of the light wires strung loosely on the ceiling of the house was ignited by the heating due to the short circuit, and the blazing and live wire fell on the crowd, further heightening the panic. Some man, cooler than the rest, placed a ladder and cut the wire down with pliers.

The fire which started the panic did not extend beyond the projection booth. The operators of the machine explained afterwards that they had just finished showing one of the reels, when a short circuit occurred. A spark from this arc fell on the exposed film, which flared up. This flare and the crackling noise from the arc was responsible for the cry of fire.

Although they made attempts to tear off the film and throw it through the small windows to the outside, it burned too rapidly for the operators, who then tried to beat out the flame with their coats. Through economy, the manager of the theatre had provided no extinguishing apparatus in the booth. The operators were soon joined by some of the audience who brought up buckets of water and succeeded in putting out the fire.

The wiring system of the theatre was so poorly installed that the operator said he was never sure which sets of lights was going to come on when he turned a switch. There must have been many chances for a "short" to occur. The principal feature of this affair was the panic, for the fire itself proved negligible. With such a comparatively small audience, there would seem to be no occasion for such a catastrophe, but with the contributing factors of a locked emergency exit and inward-opening doors usual to such disasters, it is perhaps not so surprising.

It demonstrates again that there is always the danger of serious consequences from panic due to fire, notwithstanding how unimportant the actual fire may be. A similar fire took place in Cannonsburg, Pa., August 27, 1911, when 26 persons were killed in a moving picture theatre. A boy in the audience shouted "Fire!" and a panic ensued. (QUARTERLY, Vol. 16, No. 2, p. 162.)

A view of the burned district at Shreveport, La. The conflagration started with a fire in one of the houses whose ruins are seen at the right.

Shreveport Conflagration.

Report by Louisiana Fire Prevention Bureau.

(Member N. F. P. A.)

Shreveport, Louisiana, suffered a conflagration on September 4-5, 1925, which, primarily serious because of the presence of wooden shingle roofs, was made disastrous by the fact that the water supply of the city was out of order at the time of the fire. The property loss is variously estimated at between $750,000 and $1,000,000. Had there been a high wind from a westerly direction or had the fire occurred in the high value district the conflagration might have spread throughout the entire high value area.

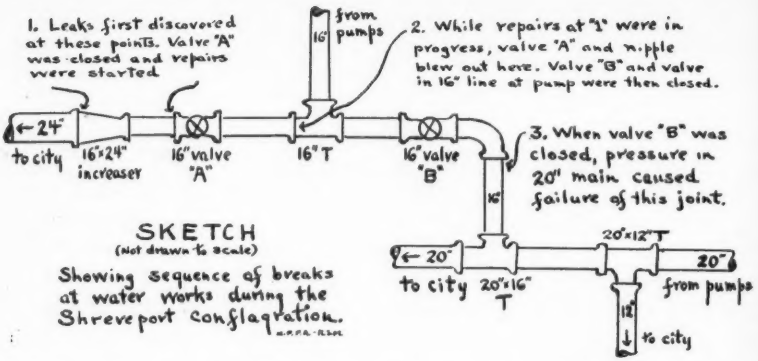
The area involved in the fire was a strictly residential neighborhood, consisting mainly of one-story, frame dwellings grouped, in places, with from 3 to 10 foot clear spaces between. Exclusive of a few minor outbuildings, there were 196 houses destroyed; 190 were one-story, 6 were two-story; 160 were covered with wood shingles and 36 were covered either with metal or composition roofs. Street widths are 38, 58, and 60 feet. Blocks average 600 by 275 feet, divided into smaller blocks by one or two 15 to 20 foot alleys.

Protection.

This particular section of the city, especially around the space of origin of the fire, was well protected by two double and six three-way hydrants on 6 inch and 10 inch mains, fed by a new 16 inch arterial feeder lately installed and traversing Ford Street in an east and west direction. Spacing of the four fire alarm boxes available averages 1040 feet. Fire Station No. 4, containing one combination pumper and hose chemical, was located within 200 feet of the origin of the fire and one fire alarm box was located 450 feet distant, corner of Allen Avenue and Garden Street.

Breaks in Water Mains.

On August 31, some seepage was noted at the waterworks plant near the point of interconnection between the 16 inch, 24 inch, and 20 inch mains near the southeast corner of the filter gallery, where mains are beneath the roadway. At first, it was thought that this was due to the condensed steam from a steam line nearby, but this idea was held untenable as the seepage increased. On September 3, the exact location of the leak was discovered by the superintendent of the waterworks plant by the operation of valves at different points and this section of piping was cut out to stop this leak at 5 P. M. Thursday, September 3. Trenching


1. Leaks first discovered at these points. Valve "A" was closed and repairs were started
16" from pumps
2. While repairs at "1" were in progress, valve "A" and nipple blew out here. Valve "B" and valve in 16" line at pump were then closed.
← 24"
to city
16"×24" increaser
16" valve "A"
16" T
16" valve "B"
3. When valve "B" was closed, pressure in 20" main caused failure of this joint.
16"
20"×12" T
← 20"
20"
to city
20"×16" T
from pumps
12"
to city
SKETCH
(Not drawn to scale)
Showing sequence of breaks at water works during the Shreveport conflagration.

operations were immediately started to uncover this section of pipe and in the morning of the following day, the leak was uncovered. It was found to be on the under side of the joint where a 16 x 24 inch increaser joins the new 24 inch discharge main, installed eight or nine months ago. From an examination it seemed that the joint, probably due to the working or undulations of the new pipe in a newly dug trench, had settled, so that there was insufficient packing on the under side. As this pipe joint was of the bell and spigot cast iron type, some settling always takes place before the line becomes set. In order to stop this leak, it was necessary to cut out a section of the pipe, and replace the piece near the bell of the increaser with a longer piece of pipe, then slip a repair sleeve over the point where the pipe had been cut, calking both sides of the sleeve. At 3:30 P. M., Friday, September 4, pipe had been cut from the 24 inch line, the longer length of pipe had been lowered into the trench, the repair sleeve had been obtained and was being set, when another joint on the pump side of the closed 16 inch valve blew out at a 16 inch tee, flooding the trench where the first leak was being repaired. Additional 16 inch valves in the station at the pump and in the cross connection were then closed to segregate this break, service being maintained through a 20 inch line with a 12 inch branch, both lines being controlled by a single valve at station. One of the valves operated to close off this second break was a 16 inch valve in the cross connection between the 16 inch discharge from the pumps and the 20 inch line. Pressure, therefore, was not equal on both sides of the gate of the valve and at 4:30 P. M. a third break occurred in a joint on the pump side of this valve. To stop this break it was then necessary to discontinue service until such time that the first break was repaired in the 24 inch line and efforts were concentrated towards putting this idea into effect. All service in the city was discontinued at or about 4:30 P. M. Only the fire department, it was stated, was officially notified of the occurrence.

Story of the Fire.

At 9:16 P. M., Friday, September 4, an alarm of fire was received over telephone at fire alarm headquarters. Chief officers answered promptly and a second, or general, alarm was sounded by the Chief and received at 9:23 P. M. All apparatus then responded. At the start of the fire, the officer of Engine Company No. 4, about 200 feet distant, was sitting in front of the station when telephone rang, which he answered. After answering the telephone, several persons called the location of the fire, which was in the bathroom of 1535 Garden Street, a one-story, frame, shingle roof dwelling, occupied by two families. Efforts were then made to extinguish the blaze with a 2½-gallon soda-and-acid extinguisher, and a line from the 40-gallon chemical tank on the fire apparatus in the station, but a burst of flame, after about two minutes of operation, forced the men outside, abandoning the chemical hose and hand extinguisher. A few minutes afterwards, the two-story, frame, shingle roofed dwelling at 1534 Garden Street, on the opposite side of a 60-foot street, burst into flames, after which fire spread rapidly through this area. What little wind there was, was from the southeast and this, aided by the draft from the fire itself, was sufficient to carry the heat wave over the area shown on the accompanying map. At or about 1:30 A. M., Saturday, September 5, the fire had practically burned itself out, being stopped by the Texas & Pacific right-of-way, 100 feet wide on the east, and sparsely populated and open country on the north. In the meantime, the waterworks repair crew were able to repair the first break described, to give service through the 24 inch line. At about 2 A. M., Saturday, September 5, valves were operated for this purpose, pressure was built up to 25 pounds, when a fourth break occurred in the repair sleeve by the calking being pushed out. This sleeve was immediately taken out, a cast iron sleeve substituted, calked and service was resumed at 7 A. M., Saturday, September 5.

Cause of the Fire.

Cause of the fire was not determined. It was thought at first that the fire was of incendiary origin due to an altercation that had taken place between the two tenants of 1535 Garden Street shortly prior to the beginning of conflagration. Another theory advanced was that it was due to the explosion or overheating of a portable oil heater that had been used to heat an infant's food.

Conclusions.

The fact that the fire approached conflagration dimensions was undoubtedly due to the lack of water, for with the prompt response of the fire department it would probably have been confined to its point of origin and with the cooling effect of the water, the heat of the burning gases would not have been allowed to ignite buildings sometimes a block or a

half-block away. The fire happened after a season of sustained hot, dry weather, so that the shingle roofs involved were in a condition very susceptible to ignition. The rapidity of the spread of the fire can be evidenced by the testimony of the chief of the fire department, who stated that after settling upon a line of houses to be dynamited to form a barrier to prevent the spread of the blaze, it was seen that the fire had entirely jumped this line of houses and caught others beyond and in line

of the direction of the wind. As noted above, the majority of the houses, singly or in groups, were covered with wood shingles. This construction again illustrates the action of the "heat blast" that travels ahead of a large fire and has been known to ignite buildings several thousand feet away. This action is also attested to by statements of on-lookers who stated that entire roofs and sometimes whole houses, not themselves directly in the path of the flames, would burst into flames at once.

At the waterworks station, it is to be noted that while the pipe was not strapped together as is required in sprinklered underground work, such construction that obtained is common in general waterworks practice. The valve involved had necessarily been operated when the 24 inch main had been substituted for a former 16 inch main and there was no reason apparently to think that the joints causing the second and third breaks were unsafe, as they had been laid in tightly packed ground in a 6 to 8 foot trench. Sleeves similar to that which afterwards blew out had been used elsewhere in the system for similar purposes, with uniformly good results and there was obviously no reason to suppose that it would fail in this instance, especially at such comparatively low pressures.

Recommendations.

The cross connections and additional 24 inch main at pumping station as previously recommended and laid out should be completed. An ordinance against shingle roofs, prohibiting them from being used within the corporate limits of the city, should be passed and enforced.

NOTE—The improvements and changes around the waterworks station were in line with enlargements recommended by the National Board of Fire Underwriters and the Louisiana Fire Prevention Bureau in October, 1919, May, 1922, and December, 1923. The results of the break in the valve in the 16 inch cross connection were foreseen as early as 1919 by the National Board and attention was called to that condition both in the report issued April, 1924, and in conferences prior thereto in May, 1922, and in December, 1923, and a detailed report showing defects was submitted on May 5, 1924. It is considered, however, that extension of the line into rapidly developing neighborhoods and the enlargement of the system had occupied the time of the city's forces. The new 24 inch and 16 inch main laid on Common, View and Ford Streets, thence to the Queensboro section, had been completed March 15, 1925. To prevent a recurrence of this interruption to service it is planed to lay an other independent 24 inch main from the waterworks pumps to the distribution system by a separate route and so to cross-connect this main with the 24 inch, 20 inch, 16 inch and 12 inch mains in service with a properly valved 24 inch cross connection so that any combination of mains can be used.

Kelvin Hall Fire, Glasgow.

By Alexander Young.
(Member N. F. P. A.)

Tuesday, the 7th of July, 1925, will long live in the memory of Glaswegians on the account of the alarming fires that occurred that day and caused damage estimated at over £200,000.

About 2 o'clock in the morning, fire was discovered in the malt house of Messrs. Hugh Baird & Sons, Port Dundas, and damage of about £75,000 resulted. Fears were entertained for the safety of adjoining buildings, but the firemen were able to restrict the outbreak to the malt house. It was a brick and slated building measuring 200 feet by 60 feet, and was six stories in height. The three top floors, which contained a large quantity of malt and grain, were badly damaged and the roof was burned off. While this fire was in progress, the fire brigade was called to deal with another fire at 31 Kyle Street, in the same district, but this outbreak was soon extinguished, and the damage only amounted to £500.

The large staff of firemen engaged at the malt house fire returned to their stations expecting a rest, but about 6 P. M. a general call was issued to all the fire stations in the city, and the rush of fire engines from so many quarters made people aware that some specially threatening fire had broken out. The scene of the fire was the Kelvin Hall in the West End of the city. This fire was not in any way connected with the two Port Dundas fires earlier in the day. Port Dundas district lies about 1½ miles to the northeast of Kelvin Hall.

The Kelvin Hall was known far and wide on account of the exhibitions and carnivals held there regularly since the Great War. The hall was one story in height, covered an area of 13,180 square yards and was built almost entirely of brick, wood, and glass, wood predominating. The frontage was of brick with a stucco facing, and almost the whole roof was covered with tarred felt. The building was a war-time structure. During the Great War, it was decided to hold British industries fairs in one or two large centres throughout Britain. Glasgow, naturally, was one of the centres chosen, but as there was not a public hall large enough, a temporary structure was planned in 1917. It was necessary to get the permission of the Ministry of Munitions for the materials to build, but no difficulty was experienced as the Ministry recognised the uses to which such a hall could be put for military purposes. After one industries fair

The Kelvin Hall in flames. The tower of Glasgow University can be seen through the smoke: the buildings on the right are the Blantyre Street tenements referred to in the story. This photograph was taken by a nurse from the Royal Hospital for Sick Children.

had been held in the new hall, it was commandeered by the military authorities, and used for the remainder of the war as an army clothing depot.

That the hazard of this building was a well recognised one is shown by the following clipping from the Glasgow *Evening News* of December 9, 1924:

The Motor Show and Kelvin Hall.

Now that the Motor Show is over for another year—or more—one may be permitted to focus attention on the fire risk at Kelvin Hall. Leaving aside the admitted care and vigilance of the Corporation employees, including the fire brigade, it cannot be disputed that the Kelvin Hall, on such occasions as the Motor Show, is a very heavy fire risk indeed. The rules and regulations laid down by the Corporation are very drastic, and include the condition that all cars, before entering the building, must have their reservoirs emptied of petrol. It is, however, the careless and thoughtless member of the public who is the greatest danger, as was exemplified the other evening when the writer and others in the hall witnessed a gentleman nonchalantly throw to the floor a lighted wax vesta, after lighting his cigarette. The match burned for several seconds—until, in fact, its life was extinguished by the application of the heavy boot of an on-looker.

One can readily imagine the extent of the damage to such highly priced exhibits, as at the Motor Show, if even a slight fire occurred. It has been estimated that the aggregate value of all the cars at the Show exceeded one million pounds, so that most insurance companies were carrying very heavy liabilities.

Courtesy *The Bulletin.*

View of the ruins of Kelvin Hall showing a part of the roof which was corrugated iron. Glasgow University is at the left and the Art Galleries and the Blantyre Street tenements at the right.

The fire appears to have started in the southwest corner of the hall, and by the time the fire brigade arrived the flames had obtained a firm hold.

In little over an hour, only the bare walls were left standing, although the interior was still a mass of blazing debris. The damage to the hall is estimated at about £70,000. The heat generated by the fire was intense, and the fresh westerly wind carried the full blast of the heat across Blantyre Street, 50 feet wide, against stone and slated tenements of four stories in height occupied as small dwelling houses.

Over 70 dwellings had to be hurriedly vacated, but fortunately this was accomplished without serious accident. In these dwellings, scarcely a window facing the fire remained unbroken, and many casements and curtains were blazing. Portions of the roof were aflame, but owing to the strenuous and efficient work of the fire brigade the fires were kept in control.

The total damage to the buildings and contents of these dwellings is estimated at £5,000. Had the fire occurred at night, the plight of the tenants would have been very serious. Owing to the light construction

Courtesy *Daily Record and Mail.*

Ruins of Kelvin Hall showing how it exposed the Art Galleries (in background) and the Blantyre Street tenements (at right).

of the Kelvin Hall, sparks and flaming felt and embers were borne long distances, and owners of property in the vicinity, as well as the firemen, had an anxious time.

Although Glasgow University, the central tower of which is seen through the smoke of the photograph on page 181 and in the left background of the picture on the opposite page, was never in any danger owing to the direction of the wind, this was not the case with the Corporation Art Galleries, which are seen in the illustration above. For a time, there was considerable risk of fire, and lines of hose were laid all around the building and two engines remained continuously on duty. Men were posted on different points of the roof and a strict watch kept. Two parts of the roof were actually ignited, but the prompt measures taken were successful in suppressing the outbreaks.

A good deal of smoke penetrated to the inside of the galleries, but the valuable art treasures escaped injury. The value of the building and its contents cannot be less than £1,250,000.

While the Kelvin Hall was still blazing, a sudden stampede eastwards of a large portion of the crowd gave the alarm of another outbreak. This was at the College and Kelvingrove Church in Kelvingrove Street, about 500 yards east from the Kelvin Hall. A number of fire engines were immediately rushed to the spot, and on arrival the roof was found to be

Courtesy *Daily Record and Mail.*

The fire at Kelvingrove Church. Although 500 yards from the Kelvin Hall fire, embers, carried on the breeze, ignited the church roof and by the time firemen and equipment could get there from the other fire the entire interior was destroyed. Sparks from this fire in turn ignited several dwellings not far distant.

ablaze. Within fifteen minutes of the discovery of this fire, the interior of the building was a raging furnace.

This church, which occupied an island site (surrounded by streets, not water) was one of the most handsome buildings in Glasgow. It was about 40 years old, Basilican in form, and modeled after the style of La Ste. Chapelle in Paris. Although the value of the church and its furnishings must have been about £80,000, the damage is estimated at £50,000. As in the Kelvin Hall fire, so here, the wind blew sparks and flaming embers towards the tenements across the street, and within a short space of time, two roofs were ablaze.

The firemen were beginning to get the upper hand of these subsidiary outbreaks when the alarm was sounded that yet another fire had broken out on the roof of a villa in Royal Crescent about 100 yards further east from the church. A detachment of the brigade was at once detailed to deal with this outbreak, and with yet another but smaller one nearby. After an hour's strenuous work at this point, practically all danger was past. Damage to dwellings in Kelvingrove Street is estimated at £5,000, and to Royal Crescent dwellings at £6,000.

Courtesy *The Bulletin.*

Another view of the Kelvin Hall ruins showing the Royal Hospital for Sick Children in the background.

In all, about 220 firemen were on the scene of the various fires, and most of them were exhausted by the time the fires were extinguished, as the majority had been fighting a series of outbreaks since 2 o'clock the previous morning. Although the fires spread over so wide an area, it is an extraordinary fact that no lives were lost, and only two individuals, a fireman and a civilian helper, suffered from minor burning injuries.

Theories as to Origin of Fire.

The cause of the Kelvin Hall fire is unknown, and many theories have been advanced as to its origin. It is suggested that intense heat from the sun caused the felt roof to smoulder and it then burst into flame. Many are of opinion the cause was a spark alighting on the felt roof. The spark may have come from a passing locomotive, as a low level railway line emerges from a tunnel quite near the rear of the hall. The generally accepted view of the subsequent outbreaks is that sparks and embers were borne on the wind.

Lessons from the Fire.

The outstanding lesson of the fires is the folly of permitting so flimsy and extensive a structure as the Kelvin Hall to exist as a menace to life and property. Thousands of dwelling houses and business premises were in the danger zone, and in addition to the Art Galleries other important

buildings within 400 yards are, the Western Infirmary, the University, and the Royal Hospital for Sick Children. From the Kelvin Hall, it is only about 650 yards south to the River Clyde with its valuable shipping, transit sheds, and the like. As already mentioned, the flaming embers started fires over 500 yards distant. The Kelvin Hall was empty at the time of the outbreak, and it represented the burning of a shell. Had a show or carnival been going at the time, there would have been so much more material for the flames, it is unlikely Blantyre Street tenements could have been saved. The material loss would have been enormous, but that fades into insignificance when the grave danger to the public is contemplated. The avenues in the hall were often so thronged with people that it was difficult to move. The very thought of the consequences of fire at such a time is horrible. It is also fortunate that there was so large an open space like Kelvingrove Park in the line of the flying embers.

Why, too, should it not be made compulsory that all buildings where huge values are concentrated or where large numbers of the public congregate be of fire-resisting construction or be protected by automatic sprinklers?

Gladsonia Apartment Fire, Detroit.

Report by Michigan Inspection Bureau.

(Member N. F. P. A.)

Fire, starting in the "Gladsonia," an apartment under construction at 2644 Gladstone Avenue, Detroit, July 22, 1925, developed four-alarm proportions, and while destroying the apartment itself, badly damaged most of the surrounding buildings. This fire is noteworthy because it shows how several adverse circumstances can conspire to make a fire, initially unimportant, a serious one. The loss is probably $250,000.

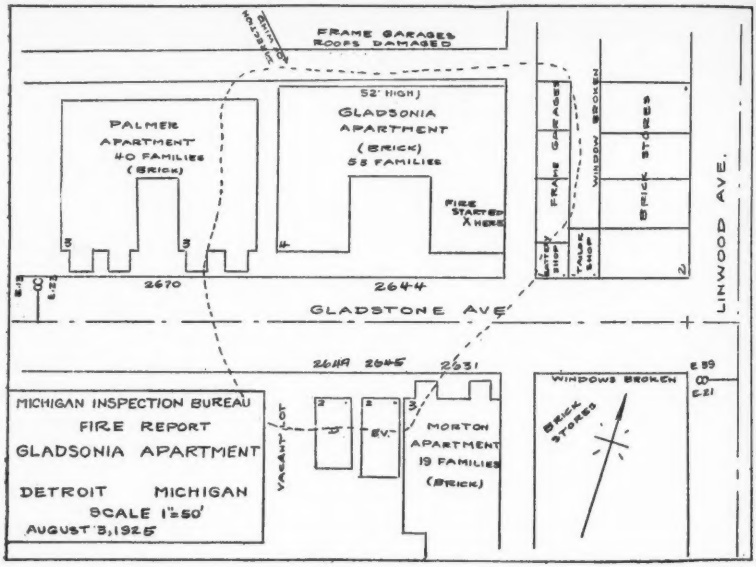
The apartment was of three stories and basement, and construction work was complete except for plaster, interior trim and the installation of windows. Carpenters, plumbers, electricians, iron and other workers were at work when the fire started.

The Story of the Fire.

At the time of the fire a structural iron worker was using an acetylene torch on the second floor of the east wing of the building, his helper standing by with a pail of water to extinguish any incipient fires which sparks of molten metal from the torch might cause. Evidently however, some of the sparks fell through the flooring to the floor below. About six minutes after they had finished their cutting operations, and as they were picking up their tools preparing to leave, these workmen noticed smoke coming up from the first floor and someone shouted "Fire!" Running to the first floor they quickly saw that the fire was out of their control, so they returned to the second floor and attempted to remove the acetylene tank. Smoke and fire prevented their doing this however.

Several persons attempted to call the fire department on the telephone, but the spreading fire had severed the telephone cable in the rear of the building. After considerable time had been lost in this process, someone pulled the alarm box at the corner of Gladstone and Linwood Avenues and the response of three engines and one ladder company was prompt. Although when they arrived the apartment itself was a mass of flames and buildings across the street were already burning, they lost no time in getting to work and shortly had four lines of hose laid and playing on the fire. Due to the delayed alarm the firemen started work under a serious handicap.

A further handicap for second, third and fourth alarm companies developed in the form of traffic congestion due to the concourse of automobiles and pedestrians near the scene of the fire. As the firemen got to work they gradually surrounded the burning buildings and by deluging



them with water confined the fire to the area outlined on the accompanying diagram. Automobiles parked on Gladstone Avenue near the scene of the fire were driven or pushed away before the first fire companies arrived, but the companies responding to subsequent calls found parked machines greatly in their way.

It is estimated that at least 25 shingle roof fires, caused by flying brands, broke out in different locations within one or two blocks of the fire. These fires were put out by firemen off duty and by citizens with hand extinguishers and garden hose.

Conclusions.

Education must continue regarding the independability of the telephone as a means of summoning the fire department as long as there is any other means. The fire alarm box should be immediately pulled whether an alarm is sent in by telephone or not.

Traffic regulation is essential if the fire department is to be able to respond promptly to an alarm and get to work without delay. Here they were not only delayed on the way, but on arrival at the fire were obliged to move cars in order to go to work.

An occupied apartment is required to be equipped with fire extinguishers and is subject to regular inspection for fire hazards, while a building under construction, although containing hazards such as

plumbers' blow torches, acetylene welding equipments and the like, receives no fire prevention supervision at all. More attention should be paid to such buildings, and first aid fire fighting appliances should be always readily available.

The fire again demonstrates that combustible roof coverings are a serious hazard. That it was necessary to put out 25 separate fires due to flying brands on wooden shingle roofs indicates that there is a serious hazard of conflagration whenever these roofs are found.

Although the state housing code requires fire walls separating every four families in apartments of over 20 families, the fire walls in the apartment at the west of the one where the fire originated did not extend through the cornices, and fire starting from exposure, traveled very swiftly through this concealed space. Apartments in general should be inspected for extensive blind attic spaces and for dumb waiter openings into these spaces.

New York Pier Fire.

Report by New York Board of Fire Underwriters.

(Member N. F. P. A.)

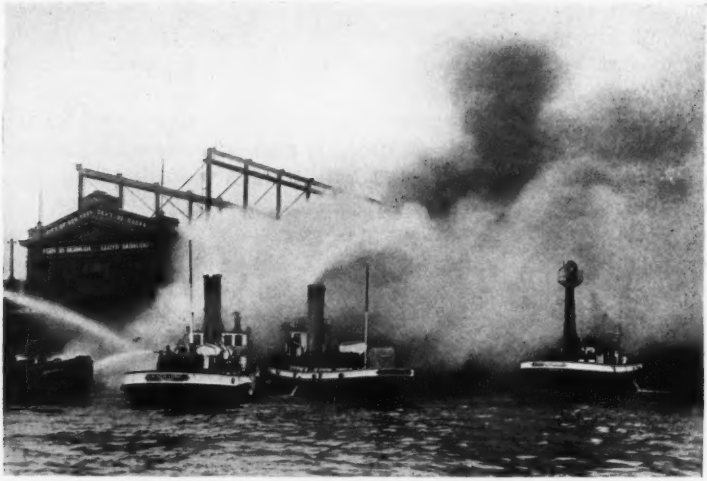
A fire starting in wood flooring from a cause not definitely determined did some $100,000 damage to Pier No. 95, North River, at the foot of 55th Street, New York City, on the evening of August 31, 1925. The fire necessitated four alarms and was finally put out by mobilized forces consisting of 16 engines and six ladder companies, a water tower and three fireboats assisted by three private tugs.

The pier is a two-story structure with side walls of corrugated iron on steel frame, and ends of brick. The roof is composition on wood, supported on steel trusses in turn supported by the steel wall frame.

The flooring of the pier shed consists of a 2¼ inch layer of asphalt on 6 inch concrete flat arches on 4 inch planking. Outside of the bulkhead portion of the pier, which is of stone filled with earth, the flooring is supported on 12 by 12 inch wood girders and piling.

In the pier was stored miscellaneous merchandise and baggage, none of which offered any particular hazard. There was a moderate supply of painting materials in a small carpenter shop and storage room for ship supplies.

The river end of the pier, outside the pier shed, was entirely of wooden construction, being of 4 inch planks on twin 6 by 12 inch wood girders on cap logs and wooden piling, there being no concrete cover as in the pier shed. It was under the planking in this section that the fire originated. There being no heating pipes or electric wiring in this section,



Underwood and Underwood Photo.

Fireboats and tugs manoeuvering to fight the four-alarm fire that destroyed the substructure of Pier No. 95 at 55th Street, New York City, on August 31. A high tide made the under side of the pier, where the fire was, difficult of access.

a cigarette dropped between the planks, or spark from a passing tug, is blamed for the fire. The end of the pier is used for transferring immigrants to Ellis Island and had been so used the day of the fire. For this reason the cigarette explanation seems the most reasonable, it being assumed that a cigarette dropped between the planking about noon when that end of the pier had been crowded, ignited the dry timber work, which smouldered until it was discovered shortly after 5 o'clock.

Story of the Fire.

A watchman, noticing smoke at the river end of the pier, sent in an alarm. The force on the pier ran out a line of standpipe hose while waiting for the fire department and began to remove planking above the point from which smoke was issuing. Fanned by a brisk westerly wind the fire spread under the concrete floor cover of the pier deck proper, burning away the planking, practically all the girders, and many of the cap logs. The fire extended back toward the land end of the pier some 300 feet.

On account of the rising tide and the small clearance between the water and the substructure of the pier, it was not possible to fight the fire effectively from rafts or boats under the pier. Gas company employees aided the fire department by cutting openings with electric drills through the asphalt and concrete floor of the pier.

Conclusions.

This fire emphasizes the well-recognized danger of not providing a fire-resistive covering over a pier deck of combustible construction. In this case, the plank deck was covered with concrete and asphalt, except in the small space beyond the pier shed at the river end. Here doubtless fire originated, the initial spark, from whatever cause, finding its way into the crack between the planking, smoldered for some time. When it did get a start, the fire spread rapidly because of the accumulation of splinters and finely divided wood dust that invariably covers the supporting members underneath the pier deck.

The fire also seems clearly to demonstrate the necessity of following modern fire protection measures in the construction of piers. It is quite probable that the fire could have been controlled with far less damage had there been fire stops installed on the under side of the pier deck and had proper fire hatchways been installed to make that space accessible to the firemen. Both of these items are a part of the Regulations of the National Fire Protection Association for Piers and Wharves, the former to prevent the spread of the fire, and the latter to permit of the firemen gaining access to the seat of the fire.

A Lightning Fire in Manila, P. I.

By E. E. Elser (Member N. F. P. A.)

A fire in Manila, on the evening of June 27, 1925, destroyed a "bodega" or storage building owned by the Philippine Refining Corporation, which contained a large quantity of copra, the dried meat of cocoanuts, causing a loss of some $300,000. Lightning is supposed to be responsible for it.

The bodega building, although of light concrete construction, was totally destroyed but to a considerable extent its contents of copra has been salvaged. The fire was kept from an adjacent mill building by an intervening concrete wall with double iron doors.

Salvage operations in progress.

An inside view of the destroyed building. Note the thin concrete side wall and the wreckage of the corrugated iron roof.

Another interior view of the bodega. Evidently considerable water was used to put out the fire.

Leather Working – Fire Record.

Harness and Fancy Leather, Trunk and Bag Factories.

This record, compiled from reports in the files of the N. F. P. A. Department of Fire Record, includes 264 fires in the harness and fancy leather classification and 338 fires in the trunk and bag manufacturing occupancy. These two classes are kept separate throughout the tables, but are treated in the same fire record because of the fact that the hazards found in the two classes are in many respects similar. This record may be considered as supplemental to the fire record on tanneries, by W. D. Milne, published in the October, 1924, QUARTERLY (Vol. 18, No. 2, p. 179). The present summary treats of two occupancies in which the product of the tanneries is used. In these occupancies there appear some hazards of leather finishing which are not very clearly differentiated from some of the hazards found in tanneries. Finishing processes, in some cases completed in the tannery, are in other cases deferred until the time when the leather is worked into its final form.

In both the occupancies covered here there are many incidental hazards in addition to those directly due to the working of the leather. A number of other materials are used in these occupancies, being responsible for several special hazard fire causes, as is brought out in the tables. Straw and other stuffing for horse collars, etc., will be found responsible for several of the special hazard fires in this class. In the trunk and bag occupancy there are also other materials used, principally metal and wood.

In both occupancies treated the common causes predominate with matches-smoking first on the list and rubbish or sweepings second. Of the special hazard causes the most important is that incident to the heating of glue, wax and various cements used in the course of assembling. The other special hazard causes brought out in the table need no special comment.

The table of sprinkler performances shows a very satisfactory result of automatic sprinkler protection in these occupancies, there being but 3 fires out of a total of 173 where the sprinklers did not either extinguish or hold the fire in check. As in other occupancies the loss record also demonstrates conclusively the value of sprinkler protection. In sprinklered properties, eighty per cent of all fires reported were extinguished with a loss of under $5,000, while in the unsprinklered plants more than half of the total number of fires resulted in large losses.

Common Causes.

	Harness and Fancy Leather		Trunk and Bag		Total	
	No. of Fires	%	No. of Fires	%	No. of Fires	%
Matches or Smoking	54	39.4	13	31.8	67	37.7
Rubbish or Sweepings	16	11.7	3	7.3	19	10.7
Power	11	8.0	2	4.8	13	7.3
Oily material	11	8.0	3	7.3	14	7.9
Lighting	9	6.5	1	2.4	10	5.6
Heating	8	5.9	5	12.2	13	7.3
Boiler	8	5.9	7	17.1	15	8.4
Incendiary	8	5.9	4	9.8	12	6.7
Exposure	5	3.6			5	2.8
Miscellaneous	7	5.1	3	7.3	10	5.6
Total	137	100.0	41	100.0	178	100.0

Special Hazard Causes.

	Harness and Fancy Leather		Trunk and Bag		Total	
	No. of Fires	%	No. of Fires	%	No. of Fires	%
Heating of glue, wax, etc.	10	22.2	4	50.0	14	26.4
Flammable liquids	7	15.5			7	13.2
Application of flammable liquid coatings	5	11.1			5	9.4
Drying	4	8.9			4	7.5
Buffing	2	4.5			2	3.9
Spontaneous ignition—						
Leather and clippings	9	20.0	1	12.5	10	18.8
Straw and rags	3	6.7			3	5.8
Pickers and Openers (Handling Stuffing)	2	4.5			2	3.9
Explosion of celluloid scrap	1	2.2			1	1.8
Dyeing leather			1	12.5	1	1.8
Dry Kiln			2	25.0	2	3.9
Miscellaneous—						
Acetylene torch	1	2.2			1	1.8
Sparks from forge	1	2.2			1	1.8
Total	45	100.0	8	100.0	53	100.0

Summary of Causes.

	Harness and Fancy Leather		Trunk and Bag		Total	
	No. of Fires	%	No. of Fires	%	No. of Fires	%
Common Causes	137	51.9	41	55.4	178	52.6
Special Hazard Causes	45	17.0	8	10.8	53	15.7
Total Known Causes	182	68.9	49	66.2	231	68.3
Unknown Cause	82	31.1	25	33.8	107	31.7
Total	264	100.0	74	100.0	338	100.0

Analysis of Loss.*

	Harness and Fancy Leather		Trunk and Bag		Total	
Sprinklered Fires	No. of Fires	%	No. of Fires	%	No. of Fires	%
Small Loss	141	82.0	33	73.3	174	80.1
Large Loss	31	18.0	12	26.7	43	19.9
Total with Data	172	100.0	45	100.0	217	100.0
No Data	5				5	
Total	177		45		222	
Unsprinklered Fires	No. of Fires	%	No. of Fires	%	No. of Fires	%
Small Loss	38	49.3	7	29.1	45	44.5
Large Loss	39	50.7	17	70.9	56	55.5
Total with Data	77	100.0	24	100.0	101	100.0
No Data	10		5		15	
Total	87		29		116	

Day or Night Fires.

(Day Fires 6 A. M. to 6 P. M.)

	Harness and Fancy Leather		Trunk and Bag		Total	
	No. of Fires	%	No. of Fires	%	No. of Fires	%
Day	100	39.2	28	38.9	128	39.1
Night	155	60.8	44	61.1	199	60.9
Total with Data	255	100.0	72	100.0	327	100.0
No Data	9		2		11	
Total	264		74		338	

How Discovered.

	Harness and Fancy Leather		Trunk and Bag		Total	
	No. of Fires	%	No. of Fires	%	No. of Fires	%
Employee	76	30.9	16	23.5	92	29.5
Sprinkler Alarm	57	23.3	16	23.5	73	23.2
Watchman	22	8.9	12	17.7	34	10.8
Supervisory System	18	7.3	3	4.4	21	6.6
Thermostat	15	6.1			15	4.8
Outsider	58	23.5	21	30.9	79	25.1
Total with Data	246	100.0	68	100.0	314	100.0
No Data	18		6		24	
Total	264		74		338	

*Large loss fires are fires causing damage greater than $5,000.00.

Room in Which Fire Occurred.

	Harness and Fancy Leather		Trunk and Bag		Total	
	No. of Fires	%	No. of Fires	%	No. of Fires	%
Finishing process rooms	14	12.1	4	9.3	18	11.4
Other Manufacturing rooms	29	25.4	13	30.3	42	26.6
Straw Vault	4	3.4			4	2.5
Misc. non-working portions	15	13.0	7	16.2	22	13.9
Basement	16	13.9	2	4.7	18	11.4
Boiler House	13	11.3	10	23.3	23	14.5
Storage	24	20.9	7	16.2	31	19.6
Total with Data	115	100.0	43	100.0	158	100.0
No Data	149		31		180	
Total	264		74		338	

Effect of Sprinklers.

	Harness and Fancy Leather		Trunk and Bag		Total	
	No. of Fires	%	No. of Fires	%	No. of Fires	%
Extinguished Fire	129	82.1	26	70.3	155	79.9
Held Fire in Check	27	17.2	8	21.6	35	18.0
Total Satisfactory	156	99.3	34	91.9	190	97.9
Unsatisfactory	1	.7	3	8.1	4	2.1
Total	157	100.0	37	100.0	194	100.0

Number of Heads Opened.

No. of Heads Opened	Harness and Fancy Leather		Trunk and Bag		Total	
	No. of Fires	%	No. of Fires	%	No. of Fires	%
1	65	41.7	9	25.6	74	38.8
2	35	22.4	7	20.0	42	22.1
3	20	12.8	6	17.0	26	13.6
4	12	7.6	2	5.7	14	7.3
5	3	1.9	2	5.7	5	2.6
6-10	14	8.9	4	11.6	18	9.5
11-15	1	.7	1	2.9	2	1.0
16-25			2	5.7	2	1.0
26-35	2	1.3	1	2.9	3	1.6
36-50	2	1.3			2	1.0
51-100	1	.7			1	.5
Over 100	1	.7	1	2.9	2	1.0
No Data	1		2		3	
Total	157	100.0	37	100.0	194	100.0

Note: There were twenty-eight fires in which no sprinklers operated.

Fires in Which There Was Loss of Life.

These notes are intended to point out typical conditions under which loss of life has occurred that they may be known and guarded against.

Woodworker.

S-40224. CHICAGO, ILL., AUGUST 10, 1925. The fire was started by a back fire from the boiler to the brick shavings vault. This vault is of brick and extends five stories from the basement to the roof where it receives the discharge of a metal cyclone collector. The shavings are fed to the boilers both by hand and through a short metal chute from the base of the vault. The first result of the back fire was a heavy explosion in the vault which wrecked part of the metal ducts and blew out most of the windows. The explosion was immediately followed by a flash of fire which broke out almost instantly on the second, third, fourth and fifth floors. Just before the fire a workman was cleaning a portion of the fifth floor which was vacant. He had opened the door into the shavings vault and was throwing in some refuse when the explosion occurred. His clothes ignited, and he was so badly burned when rescued by the fire department that he died shortly after reaching the hospital.

Dry Cleaning Plant.

H-22430. AURORA, ILL., AUGUST 25, 1925. An employee was working in the main cleaning room of the plant when a small tank of naphtha exploded. The resulting flash filled the entire room. There being but a single exit, instead of attempting to break through the flames to this door, he rushed into a small drying room adjoining, slammed the door and was trapped. Combustible fumes flowed around the door into the drying room and were ignited by the intense heat. It is believed that he was suffocated by the fumes and his body literally cooked after his death. When the fire was extinguished his body was found crumpled up in a corner of the tiny room. He was on his knees with his head buried in his arms.

Grease on Stove.

H-22215. NEW YORK, N. Y., JUNE 29, 1925. Efforts of a five-year-old boy to extinguish the fire in his mother's clothing resulted in injuries to the boy from which he died. The mother was critically burned and the father and another child were badly burned. Grease boiling over from a pan on her kitchen stove caused the flare-up which ignited the mother's clothing. The boy and his baby sister had started to run from the room, but he turned back and his clothing caught fire as he tried to save his mother.

Children and Matches.

H-22272. CHELSEA, MASS., JULY 14, 1925. A three-year-old child was fatally burned when her clothing caught fire while she was playing with matches in her home.

H-22385. MARLBORO, MASS., AUGUST 22, 1925. A four-year-old child died from burns sustained from matches with which she was playing in her home.

Candle in Closet.

H-22450. BOSTON, MASS., SEPTEMBER 19, 1925. A woman was trying to find a dress in the closet of her home and was carrying a lighted candle. The candle ignited a dress hanging there, and in a very short time two other dresses were afire. In attempting to extinguish the flames, she was burned about the head, face, arms and body. She was rushed to the hospital, where she died the next day.

Starting Kitchen Fire with Kerosene.

H-22448. WOONSOCKET, R. I., SEPTEMBER 18, 1925. A thirteen-year-old girl died from burns received about the arms and body when she attempted to quicken a smouldering fire in the kitchen stove with kerosene. The oil in the can caught fire and the can exploded, showering the child with blazing kerosene. The child ran into the yard screaming, and a neighbor wrapped her in a robe and extinguished the flames. She was taken to the hospital, but her burns proved fatal.

Airplane Fires.

H-22269. WESTBURY, N. Y., JULY 13, 1925. Two reserve officers, who were stationed at Mitchel Field for two weeks' training, were killed when their plane crashed near here and burst into flames. Passers-by ran to the burning plane, but they were unable to remove the aviators. Aid was rushed to the scene and their bodies, badly charred, were removed from the wreckage.

H-22386. WHITE SULPHUR SPRINGS, W. VA., AUGUST 23, 1925. Two men were burned to death when their airplane fell, taking fire as it crashed to the ground. Their bodies were charred almost beyond recognition.

Gasoline.

H-22294. SALEM, MASS., JULY 6, 1925. The tank of an automobile truck was being filled with gasoline, the motor idling, when there was an explosion followed by a stream of flame from the exhaust pipe, which set fire to the clothing of a woman who was standing nearby. Flames enveloped her entire body and her clothing was practically burned from her. Her husband rushed to her assistance and attempted to extinguish the flames with his hands and was badly burned as a result. A blanket

was secured and the flames were smothered, but not until she was fatally burned.

H-22370. HALIFAX, N. S., JULY 27, 1925. Two men called at a farmer's residence to borrow gasoline for their automobile which had "run out of gas." The farmer crawled beneath his own car to get some and was filling a pail when the liquid ignited from the lighted lantern he was using. His daughter and the two men attempted to extinguish the flames and were badly burned. The farmer died the next day from his injuries.

H-22431. BROOKVILLE, MASS., SEPTEMBER 23, 1925. A woman was cleaning a dress with gasoline near the kitchen stove, when the gasoline which she was using ignited. Her clothing caught fire and she was so badly burned that she died the next day in the hospital.

Fireworks.

H-22242. EAST BOSTON, MASS., JULY 4, 1925. A seven-year-old child was holding a "sparkler" in her hands on the porch. Her dress caught fire and she died the next day from her burns.

H-22327. MCKEES ROCKS, PA., JUNE 1, 1925. A truck load of fireworks exploded from an unknown cause, at a loading platform of a brick warehouse. Two men were killed and more than a score of persons were injured. Both the men were engaged at the time of the explosion in loading the truck with the fireworks. Their bodies, clothing torn off, were hurled a distance of over twenty feet, the right arms and legs of both were blown off, and they were otherwise badly mangled and burned. One man was hurled up over an embankment to a railroad siding and the other man was hurled in the opposite direction out to a sidewalk, where he was picked up and removed to the opposite side of the street before he died.

H-22347. MCKEES ROCKS, PA., JUNE 29, 1925. A ten-year-old girl was fatally burned in an explosion of fireworks that followed the lighting of a firecracker in her mother's store. The mother of the child, who conducts the store, had gone on a shopping trip and left the little girl in charge. The youngster had just lighted a firecracker, when the explosion communicating to other fireworks stored there caused a fatal blast. The child was burned all over her body and died in the hospital a short time after.